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A REQUIREMENTS ANALYSIS MODEL FOR SELECTION OF PERSONAL COMPUTER (PC) SOFTWARE IN AIR FORCE ORGANIZATIONS

THESIS

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AFIT/GSM/LSQ/88S-10

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THESIS

Presented to the Faculty of the School of Systems and Logistics of the Air Force Institute of Technology
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Preface

The purpose of this study was to determine the effectiveness of standard PC software acquisition practices in Air Force Organizations, and to see if better methods could be developed. This study was necessary in light of the wide use of PCs in the Air Force today. The methods proposed may assist organizations in choosing the right software for the right task.

Thirty people in four organizations were interviewed to develop the proposed requirements analysis model in this study. Although the small sample size limits the applicability of the proposed model to similar organizations, the strategies and methods used in approaching the software solutions may offer great potential for cost savings and positive results.

This Study could not have been possible without the advice and guidance of my faculty advisor, LtCol Richard Peschke. Thank you sir, for your patience, assistance, and positive support during this project. I wish, also, to express my appreciation to my other advisor, Beverly Handy, for the time and energy she provided in making this study valid. A wife, a friend, and a critical reviewer all in one person, you were always there for encouragement, love, and coffee on those long nights.

Dexter R. Handy

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LIST OF ABBREVIATIONS

Auth/Pres	Authoring and presentation
CO	Communications software
Comm	Communication
DB	Database management system software
Diag/Prob	Diagnosis and problem solving or problem finding
GR	Graphics software
Int/Transp	Interoperability and Transportability
IT	Integrated software systems
Monit/Cntr	Monitoring and Controlling
Org/Sched	Organizing and scheduling
OT	Other software types
PL	Program language software
Plan/D.S.	Planning and decision support or decision making
PM	Program management software
SC	Systems for Command, Control, Communications, and Computers
SCTC	Small Computer Technical Center
SS	Spreadsheet software
ST	Statistics software
SW	Software
WP	Word processing software

Abstract

The purpose of this study was to determine how Air Force Organizations selected Personal Computer (PC) software, to determine the effectiveness of standard PC software acquisition practices, and to determine if better methods could be developed. The study had three basic objectives:

1. Determining whether or not a uniform set of PC software selection criteria at base level existed.
2. Determining how effective the existing methods of selecting PC software were.
3. Determining what additional factors organizations should evaluate before acquiring PC software.

Analysis of interviews with thirty managers and users from four Air Force organizations resolved that while a normative or regulatory approach existed for determining PC software requirements, the guidance was not clear in helping users select the appropriate software for automated office tasks. As a remedy for the lack of sufficient guidance, organizations chose to select software first and then find a need to fit the software. Data suggested, however, that at times this resulted in less than optimum use of the software.

A requirements analysis model was necessary to specifically provide users with a means of categorizing their information systems requirements into knowledge work tasks, and to select software designed to satisfy the

identified knowledge work. The model, developed using tasks identified by the interview respondents and literature available on the subjects of management information system design, user involvement, and requirements analysis techniques, is presented and offered as a solution to the current problem.

A REQUIREMENTS ANALYSIS MODEL FOR SELECTION OF PERSONAL COMPUTER (PC) SOFTWARE IN AIR FORCE ORGANIZATIONS

I. INTRODUCTION

Overview

This chapter discusses the methods by which information systems requirements are determined within United States Air Force organizations. Next, the purpose of the research is detailed as well as a definition of terms, the justification, and scope of study. Finally, the specific research objectives and research questions are identified.

Background

Of the nearly 500 thousand personal computers (PCs) purchased by the federal government, 22% belong to the Department of the Air Force (20:89). In light of a decreasing technical labor force, organizations have rapidly acquired these inexpensive systems in an attempt to streamline information processing and continue to accomplish their missions (20:89). While research on the impact of the PC based management information systems in Air Force offices is limited, current studies suggest two problems. First, the rapid acquisition without proper planning has often rendered some systems ineffective (22, 19:1, 5:170, 14:322). Second, the improper planning often resulted in passive

acceptance of new systems by intended users (23, 19:6, 5:171). While acquisition and implementation of PCs has impacted office efficiency, productivity and time management, the unplanned approach used in acquiring the systems necessary for office automation may have also lessened the cost effectiveness of these programs (9:1). In addition, several factors, when not adequately addressed, tend to increase system life cycle costs despite their relatively low acquisition costs. These drivers include inadequate information analysis, limited information handling systems, poor systems development processes, and the operation and maintenance costs of the systems (22). At the 1988 Executive Seminar on Communications and Computers in Air Force Systems Command, the following problems and factors were brought to surface:

> The problem stems from the lack of a cohesive framework and planning road map to guide Air Force information system design, acquisition, and implementation. The key factors affecting this lack of cohesion are the technology explosion, the exponential growth in user requirements, ill defined requirements and technical solutions, and a difficulty in focusing programs on mission needs. The result has been a proliferation of incompatible stand-alone systems, mission support deficiencies, a duplication of effort, a waste of resources and a loss of credibility [22].

To prevent a continuation of this haphazard approach to the acquisition of PCs, a requirements analysis model should be available to assist organizations in 1) determining information system needs, 2) planning for the system

implementation, and 3) actually using the systems efficiently and cost effectively.

Two Air Force publications which address Personal Computer requirements, AFR 700-26 (Acquisition and Management of Small Computers) and AFP 700-30 (How to Determine and Justify Information Systems Requirements in an Office Environment) currently offer some assistance to users in determining PC requirements. Notably, both regulations recommend system development techniques and user involvement during analysis, but leave considerable room for individual development. Specifically, AFR 700-26 details the PC hardware/software acquisition process, but does not provide users with an analysis through which they could define their office automation needs. While AFP 700-30 provides organizations and users with a method of identifying candidate areas for automation (through the use of a top-down structured analysis technique), this publication stops short of mapping out the appropriate equipment for each critical task (consultation with the local communications squadron/staff element is suggested for determination of the exact equipment). Thus, while one publication is designed to help organizations acquire the PC's, the other publication is developed to assist the same organizations in determining areas where PCs could be used for streamlining tasks. Neither document, however, provides guidance on the critical problems of identifying the specific hardware and

software. Thus, a requirements analysis model for matching information systems with stated requirements (PC hardware, software, configuration and operations) has not been designed. The task of developing a working model for Air Force offices has yet to be undertaken.

Purpose of this Study

General Issue. Since the early part of this decade, Air Force organizations have been instructed to streamline operations and increase productivity. One of the ways to accomplish this has been through automation of critical tasks. For many offices, time consuming tasks have been simplified through the use of Personal Computers. However, no requirements analysis techniques for determining the optimum level of PC automation that these organizations need exists. A requirements analysis model should be developed to help organizations decide the following: 1) How many PC's do they need; 2) How large should they be; and 3) What type of software do they need to efficiently streamline operations? The key issue is this: "How can units define their office information system needs for PC hardware, and similarly, PC software?" This study addressed the latter part of the question by examining existing methods of PC software procurement. In addition, a model to define PC software requirements within an Air Force organization was developed.

Specific Problem. How can Air Force organizations define their PC software requirements? How effective is the existing method of acquiring PC software?

Justification

Communications and Computer Systems staff offices are availabe to assist organizations in 1) identifying information systems requirements and 2) developing technical solutions to meet those requirements. However, for PCs in particular (versus mainframes), users are often called upon to state and justify their own requirements for PC hardware and software. Current guidance on PC hardware and software selection is limited. This study addresses a portion of the overall problem by attempting to model the PC software selection process. Currently, the Air Force has been using Small Computer Technical Centers (SCTCs) to manage software libraries within each Major Command. The SCTCs distribute catalogs of commercial and user developed software programs that are available to Air Force personel. In addition, they provide government owned/licensed software to users on request. However, users have not been able to ascertain which specific programs are needed to accomplish the mission at the least cost. As a result, expensive programs may have been acquired, but seldom used to the optimum extent. Positive results from this study should reduce the cost of PC software selection by insuring the right product for the stated requirement.

Definitions

1. Application Software - Computer programs which accomplish user requirements. They can be general-purpose, commercial, vendor-supplied, or they can be programs specifically developed by users for unique problems. Examples of application software include word processors, data base management systems, and spreadsheets [8:6].

2. End-User - The principal user of a computer system's output products [15:337].

3. Information Systems Requirements Analysis (ISRA) - A step-by-step method used to help an organization identify ways to improve the operational mission. By using ISRA an organization can identify ways to increase the probability of operational mission success and decrease the cost of mission support by better information management [9:1].

4. Knowledge Work - Tasks which involve thinking, processing information, or formulating analyses, recommendations and procedures. Knowledge work activities may also include the following:

   Diagnosis and problem finding
   Communication
   Planning and decision making
   System development
   Monitoring and control
   Authoring and Presentation
   Organizing and scheduling [7:409].

5. Operating System Software - Programs which operate a computer hardware's basic system functions such as; providing basic input and output routines, file maintenance procedures, and system controls [8:6].

6. Personal/Small Computer - A specific class of equipment to include associated peripherals and software. It will be the primary end-user device for connection to networks as well as providing stand-alone processing capability. It has the capacity to execute various software programs and usually consists of at least a keyboard, disk drive, visual display device, and central processing unit with random access and read-only memory [8:3].

7. Requirement - A need for a new or improved information processing capability which when satisfied will result in an increase in the

probability of operational mission success or a decrease in the cost of mission support [9:1].

8. Software Product - Software which can be specified by name, such as DBASE III+, Lotus 123, or Word Perfect.

9. Software Type - Categories which software products may fall into, such as communications packages, graphics packages, database management systems, spreadsheets, or word processors.

10. Standard Personal/Small Computer - PC Computer resources acquired from an Air Force-wide requirements contract [8:3].

11. Systems for Command, Control, Communications and Computers Requirements Document (SCRD) - The document which specifies the required automated capability, justifies the need, identifies available resources, and serves as the validation and approval document for that need [9:1].

12. User Involvement - Participation in the system development by representatives of the target user group [12:586].

Assumptions

1. All organizations use PCs compatible with the systems listed on the Air Force Standard Small Computer Contract.

2. Representatives in the organizations selected for interview possessed the knowledge to answer specific investigative questions.

3. Interviews were objectively conducted with minimum bias.

Research Objectives

In order to develop an effective PC software requirements analysis model, the following tasks were pursued:

1. Determination of whether or not a set of uniform PC software selection criteria at base level existed.

2. Determination of how effective the existing methods of selecting PC software were.

3. Determination of what additional factors organizations should evaluate before acquiring PC software.

Research Questions

This study addressed the following questions in support of the research objectives:

1. What guidance do organizations receive when purchasing PC software?
2. What software products are organizations currently using?
3. How do organizations determine which software products to obtain?
4. Are the software products being used for their intended purposes?
5. Could a different software product have been used to accomplish the same task at less cost?
6. Which daily, mid-range and long-range operations are benefitting from the use of the software?
7. How often are individual software products used?
8. Who (by organizational position) uses the software?

Summary

The information presented thus far suggests that PC based management information systems requirements analysis may need further refinement. The research objectives and questions in this study were developed to facilitate the development of a PC software requirements analysis model. They set the framework for the literature research as well as the methodology used to in gathering data. The overall goal was to discover whether adequate PC software requirements analysis methods were available and in use, and

if better methods could be developed. The proceeding chapters support the search for answers to the above concerns.

II. LITERATURE REVIEW

The area of personal computer systems requirements analysis is currently undefined to a large extent. Current research on management information systems, however, covers a broad spectrum of analyses ranging from human factors considerations during hardware and software design stages to problems and solutions during implementation and operational stages of the systems. Such areas could be instrumental in defining software requirements for PCs in an office environment. In light of these factors, this study examined several related areas in the management information systems (MIS) requirements analysis environment. These areas included MIS requirements analysis techniques, elements or factors which may be considered during system design, and user involvement studies addressing systems implementation and end-user computing. Results of the review follow.

Requirements Analysis Techniques

Several methods for determining and analyzing MIS requirements exist in today's environment. Apparent in all methods are four strategies, including interviewing, surveying, review of organizational structure to determine the flow of information, and direct observation (21:65). The following methods are enhancements and refinements to these basic elements.

Data Flow Analysis. Data flow analysis is a technique used to show the flow of information pictorially (21:112). This allows designers and users to clarify steps in the information flow as well as the decision making process. Specific steps in the data flow analysis strategy include:

1. Study operations and ongoing processes.
2. Identify how data is processed in handling transactions and completing tasks.
3. Follow the flow of data from input, processing, through storage, retrieval and output.
4. Gradually add details at lower levels (21:112).

The benefits of data flow analysis are 1) the way in which data is pictorially defined and 2) the use of diagrams for showing interactions between elements involved in the information or decision process.

Structured Analysis and Design Technique (SADT). A more detailed method of determining requirements, SADT "consists of both techniques for performing systems analysis and design and a process for applying theses techniques which significantly increases the productivity of a team of analysts" (24:1-1). A diagramming technique which subdivides information processes into activities and data flow (actigrams and datagrams), SADT consists of the following functional analysis phases:

1. Diagramming of the activity and data aspects of the system.
2. Cross-referencing of activity diagrams and data diagrams.

3. Additional activity and data diagramming and cross-referencing, as needed, to complete the functional analysis.

4. Analyzing the sequence in which activities can occur.

5. Identifying mechanisms which will implement the functions, and which will act as a bridge to the design phase [24:3-2].

Using SADT is a further enhancement of data flow analysis techniques in that it mandates strict modern software practices including top-down design and step-wise refinement when addressing each requirement. In addition, the use of a technical committee, a project librarian, and a chief analyst insures standardization and documentation of the system requirements.

Object Oriented Design. The strength of the object oriented design technique lies in it's ability to take real world objects and operations and map them into a problem space capable of describing problems by effecting objects on nouns (4:44). Steps involved include the following:

1. Define the Problem.

    a. Determine the activity's purpose.

    b. Determine the steps performed.

    c. Where are they performed?

    d. Who performs them?

    e. How long does it take and how often is it done?

    f. Who uses the resulting information?

2. Develop an informal strategy.

    a. Write down in an english paragraph a way to solve the problem.

    b. Identify objects and their attributes.

    c. Identify operations on the objects.

    d. Establish the interface.

3. Formalize the strategy.

    a. Implement the operations (coding).

    b. Iterate, if needed (4:40-41).

Requirements analysis techniques, if used properly can yield cost savings by ensuring accurate identification of areas prime for automation. AFP 700-30 incorporates portions of the above techniques in helping users define their requirements. Once requirements are defined, the task of designing and implementing systems can begin.

Design Considerations

An effective management information system is one that streamlines day-to-day office tasks, or aids in speeding up completion of those tasks (11:292). One problem in systems design is the identification of those tasks which can and should be automated and those which should remain manual. However, two factors are likely to influence the selection of candidate tasks. These are differences between systems designers' views of the environment, and end-users' assessments of the situation. Kumar, Kuldeep, and Welke dealt with the first factor by evaluating the perceived priorities of systems designers. These researchers hoped to

substantiate or refute the assumption that systems developers pay more attention to technical and economic values during design and less attention to socio-political-psychological values (13:8). Using a theoretical model of the relationship of values to behavior, the authors determined empirically that systems designers do in fact pay more attention to the first two values (13:9). The authors felt that the reason for the displaced importance of technical and economic values over sociopolitical-psychological values was due to the reward structure imposed by upper management (13:10). In particular, since cost, schedule and performance were measurable criteria in the eyes of management, and end-user satisfaction was not, the design process was geared toward the technical and economic areas that could be quantified (13:10). Because design considerations may not adequately deal with all the areas, systems may fail upon implementation. The main point, however, is that Air Force systems requirements analysts must be aware of the users's values when determining how to design a system that will satisfy the need. Such ignorance of users' values may result in their non acceptance and subsequent system failure.

Systems analysts may or may not be aware of modern software practices (MSPs) as identified by Zmud. These practices, designed to place some structure and

standardization into the systems design phase of development, include the following:

1. Top down development
2. Structured design
3. Structured reviews
4. Chief programmer teams
5. Configuration management
6. Unit development folders [27:1427].

Zmud points out, however, that many computer specialists choose not to use these techniques because they either view them as a threat to their autonomy or they simply do not desire to learn new techniques. Such methods, if used more widely, could enhance not only the design of systems, but also the traceability of requirements. In addition to the use of the MSPs by companies which market software products (27:1425), the military attempts to model these methods. Such practices are mandated in Department of Defense Directives 2167 (Software Development Standards for Mission Critical Computer Resources) and 7935 (Development Standards for Non-Embedded Computer Resources).

While designers' values may have an impact on successful implementation of a system, identification of tasks which can and should be automated is also an important consideration in requirements analysis. If a system automates an unnecessary task while failing to streamline a "bottleneck" in the office information flow, resources are

still wasted. A study, involving the use of a model to cognitively identify unstructured tasks in an office environment as candidates for automation was conducted by Harris and Brightman (11:292). Through the use of the Critical Task Method, they attempted to understand the bottlenecks in the organization and identify areas which could be automated. Relying on the assumption that end-users can correctly identify the critical tasks which slow the production in an office (11:296), the authors used a 5-step approach to develop requirements:

1. Interview a subsample of the Knowledge workers.
2. Develop a profile of task descriptors.
3. Develop a profile of the support modes.
4. Validate the profile of task descriptors and support modes.
5. Survey the hold-out sample [11:294-295].

Using this method to determine requirements for an unstructured office environment, they were able to identify the critical tasks and thus steer system designers toward those areas.

Montazemi and Conrath (17:45), through the use of a method called "cognitive mapping", also attempted to structure information systems requirements analysis by identifying eight steps and integrating them into the cognitive mapping process. Cognitive mapping is a "mental method of representing relationships which are perceived to exist" and empirically examining the relationships to

determine the reality of the relationship (17:46-47). The authors integrated the following eight steps into the cognitive mapping process to determine bottlenecks in the information flow:

1. Identification of the user set and interfacing organization,
2. Identification of decision areas,
3. Definition of decision areas,
4. Development of a descriptive model of the system,
5. Development of a normative model of the system,
6. Development of a consensus model of the system,
7. Decision model identification and specification, and
8. Specification of information requirements [17:45-46].

Using the above method, the authors asserted that their process enabled users, who were working in a very unstructured office environment, to determine which tasks were most critical for completion of their daily projects. They were also able to determine the bottlenecks in the tasks, and were thus able to highlight candidate areas for automation. While the authors identified three limitations to this model (the way data is analyzed, the inability to account for certain inconsistencies, and an incomplete integration into general information systems requirements analysis), the cognitive mapping did improve understanding of computer decision environments by the application of data collection and analysis techniques (17:52-53).

Thus far, the designers' value set and the identification of critical tasks have been at issue. A third design consideration deals with the ability of designers to understand the cognitive abilities and limitations of users. Benbaset and Taylor (3:439) asserted that management information systems could be improved by understanding the way humans make decisions. Looking at two factors termed human deficiencies and human limitations, they suggested designing computerized decision aids which model the human decision making process.

They defined four aspects of human decision making:

1. Ability of humans to combine cues from multiple sources in making judgments - People generally prefer simple decision making strategies.

2. Ability to judge probabilistic events - An information system can facilitate the way decision makers deal with uncertainty by providing the means to judge the likelihood of probabilistic events more accurately.

3. Models of cognitive complexity - Decision aids should not be so complex that users do not understand it's decision making process.

4 Individual differences - Decision aids should be designed to facilitate various cognitive styles [3:446].

A final design consideration should be the matter in which systems accommodate users' desires. Ackoff (1:B-147) highlights five factors which designers should be aware of when developing information systems:

1. Rather than providing as much information as possible to users, systems should be designed to condense and filter relevant information.

2. Users do not always need the information they want. An explanatory model of the decision/task process will identify relevant information requirements.

3. While providing managers with the right information may result in better decision making, it is also necessary to determine how well managers can use the needed information.

4. More communications may not always mean better performance. Organizational structure and performance measurement must also be considered before allowing all managers free access to all information.

5. In addition to understanding how to use an information system, managers should also be trained to evaluate and control the system, and have confidence in the system if it is to be of any use [1:B-147].

User Involvement and End-user Computing

As mentioned earlier, user involvement is defined as participation in the system development by representatives of the target user group. An integral part of the systems implementation process, users should assist in planning and defining information requirements, in ensuring that the requirements are understood, and in determining if the information needs which have been defined are necessary (16:26). Studies have overwhelmingly pointed out that such involvement in the management information system (MIS) design process is essential, but where that involvement should be focused is questionable. Ives and Olson performed a critical analysis of studies which examined the impact of user involvement and determined that while research showed such participation was a determining factor for system success or failure, the studies did not pinpoint the

particular areas where user involvement was most effective (12:587). While more research should be performed in this area, the main point at the present time is that user involvement in the wrong areas may degrade rather than enhance system development.

In an effort to focus user involvement in the right areas, Nutt performed analysis to determine if managers, as users, could accurately specify their MIS requirements (18:139). Nutt suggested two steps critical in the MIS design process: "Identifying key activities and specifying the information required to support these activities" (18:139). In a survey of practicing managers (in lieu of business students), his study suggested a more accurate picture of MIS design concerns. Results also questioned the usefulness of cognitive style analysis, citing evidence that those factors did not appear to affect managers' information preferences (18:139). More importantly, the study showed that managers as users could, in fact, identify their MIS requirements in the right areas.

Although the main focus of user involvement is adequate requirements definition, such participation also aids in system acceptance and overall system success. Baroudi, Olson and Ives gathered empirical evidence to determine whether user involvement during information systems development would enhance both the system usage and system satisfaction (2:232). They conducted an extensive review of

similar studies and concluded that while those studies related user involvement to system quality, system usage, user attitudes, and user satisfaction, they failed to deal with three critical areas. These included a precise operational definition of user involvement, a psychometrically accurate measurement of user involvement, and an ability to generalize evidence over a broad spectrum of information systems implementations (2:232-233). In an effort to assess these issues, the authors examined two theoretical models of user involvement and tested the relationships of those models to system usage and user satisfaction.

> Model I hypothesizes that user involvement will lead to both system usage and user information satisfaction but as system usage increases it leads to increased user information satisfaction. This model is based on the belief that system use leads users to be more familiar with the system and to discover new uses for it which will, in turn lead to enhanced user satisfaction with the system [2:233].

The authors provided the following definition for Model II:

> Model 2 proposes that user involvement will also lead to both system usage and user information satisfaction but that the more satisfied the user is with the system the more he or she will be inclined use it. This model assumes that as use demonstrates that a system meets user's needs, satisfaction with the system should increase, which should further lead to greater use of the system. Conversely, if system use does not meet the user's needs satisfaction will not increase and further use will be avoided [2:233].

The results of the authors' research suggested that Model II was indeed accurate while Model I was not (2:236). While this study established empirical evidence supporting a correlation between user involvement in system development and user satisfaction as a result of system use, the authors recognized several limitations of their approach. Of interest in this review was the fact that the user involvement focus was on the middle manager (2:237). Further studies may need to be conducted at other levels of management to completely substantiate the conclusions. However, as the authors suggest, their study did substantiate the validity of user involvement in successful information systems implementation.

While users performed mainly clarification and acceptance roles in most past information systems implementations, new development tools and the previously mentioned modern software practices may allow them to take on more responsibility in the software development cycle. Such roles include not only specifying their needs, but also designing systems and software to satisfy needs. There are several benefits to this method of development. Leitheiser and Wetherbe explored the risks and opportunities of such end-user computing. End-user computing is defined as the "use and/or development of information systems by the principal users of the system's outputs or by their staffs" (15:338). Opportunities included less reliance on limited

information systems development personnel, more direct system implementation, and more ownership and acceptance by the users (15:338). Apparent risks included less standardization in design techniques, inadequate requirements specification due to lack of sufficient knowledge, less commitment to quality assurance, changing/unstable systems, encouragement of private information systems, and a possible accumulation of unnecessary information due to poor requirements analysis (15:339). Their study also noted eight reasons end-users choose to do their own computing:

1. Lead time on development requests are shorter.
2. End-users have more control over system development and use.
3. Services are not available from the MIS department.
4. MIS department procedures are not appropriate for small applications.
5. The MIS department is not perceived as being concerned about user needs.
6. End-users want to learn about computing.
7. End-users gain more flexibility.
8. The information systems developed better meet users' needs [15:338].

End-User computing is significant to this study since defining PC systems requirements may involve user identification and selection of system configuration and operation. With that in mind, certain trends involving PC end-user computing in the business world were noted by Lee.

In his study of 12 organizations, he observed that users were very satisfied with their PC's, and sought other users as key sources for help or for determining system configurations (14:321). In addition, he studied the implementation of PC based systems in two product divisions to see if user planning resulted in better use of the systems. The results indicated that while both divisions were satisfied, the division which involved users in a planning process was much more productive (14:322).

Summary of Literature

The study thus far has examined current factors which may be critical in the requirements analysis of office management information systems. Three areas; requirements analysis techniques, systems design, and user involvement were researched to determine if they should be included in determining requirements. From a review of the research conducted, it was evident that these areas must be key ingredients in requirements analysis if the system implementation is to be successful. Available literature suggests the following approaches critical in designing and implementating PC based management information systems in Air Force organizations:

1. A structured requirements technique should be used.
2. Users or end-users are capable of defining their requirements and designing systems, but may need some guidance from MIS professionals to limit the risks of end-user computing.
3. Designers and/or end-users must be made aware of cognitive limitations inherent in humans before

designing systems to prevent excessively complicated or useless systems.

4. While tools and techniques are available for identification of information requirements, no method is available for users to determine whether to satisfy those requirements using database management systems, spreadsheets, graphics, word processors, or a combination of those systems.

Such findings add to the framework for determining a working model to assist users in assessing PC software requirements. The next chapter expains the approach used to gather information from actual users of PC based management information systems.

III. METHODOLOGY

Introduction

This chapter presents the approach employed to answer the research objectives described in Chapter I. The population of interest, the type of data collected, the location of data sources, and the analytical methods are discussed. By using the approach presented, the researcher developed three models of PC software requirements analysis:

1. The Normative Model, or an explanation of the directed approach to determining PC software requirements and acquiring the software, as prescribed by Air Force regulations and policies.

2. The Descriptive Model, or an explanation of the way using organizatons actually determined the need for, and acquired the PC software.

3. The Proposed Model, or the suggested approach to determining PC software requirements and subsequently purchasing software.

The methods and procedures for developing the models are presented in this chapter.

General Method

Thirty personnel assigned to four Air Force organizations at Wright-Patterson Air Force Base, Ohio, were interviewed to determine how software requirements were identified, how software products were acquired and how the development of a PC software requirements analysis model might simplify such actions. One individual from the Aeronautical Systems Division (Air Force Systems Command) Information Systems

Technology Center was interviewed to determine the normative approach for acquiring PC software. The remaining 29 individuals were members of three organizations and were used to develop a descriptive approach. These organizations included the Air Force Institute of Technology (AFIT), the B-1B Systems Program Office (B-1B SPO), and the 2750 Air Base Wing/Logistics Squadron, Supply Branch (2750 DMS). Figure 1 displays the number of respondents interviewed by organization.

These organizations were selected for the following reasons. First, the missions of these organizations represented a cross section of Air Force organizational responsibilities. Since different mission requirements may result in different PC software requirements, a variety of missions was necessary. The AFIT mission consisted of academic graduate and professional continuing education, as well as consultant work, staff assistance and research in areas of systems management, engineering, and logistics. AFIT's mission also reflected requirements that training institutions throughout the Air Force may encounter. The B-1B SPO is responsible for research, development, acquisition, and deployment of an aircraft relatively new to the Air Force weapons inventory. As such, it's mission is comparable to many of the Air Force's other research and development programs. The 2750 DMS supports supply requirements for all of Wright-Patterson Air Force Base, and

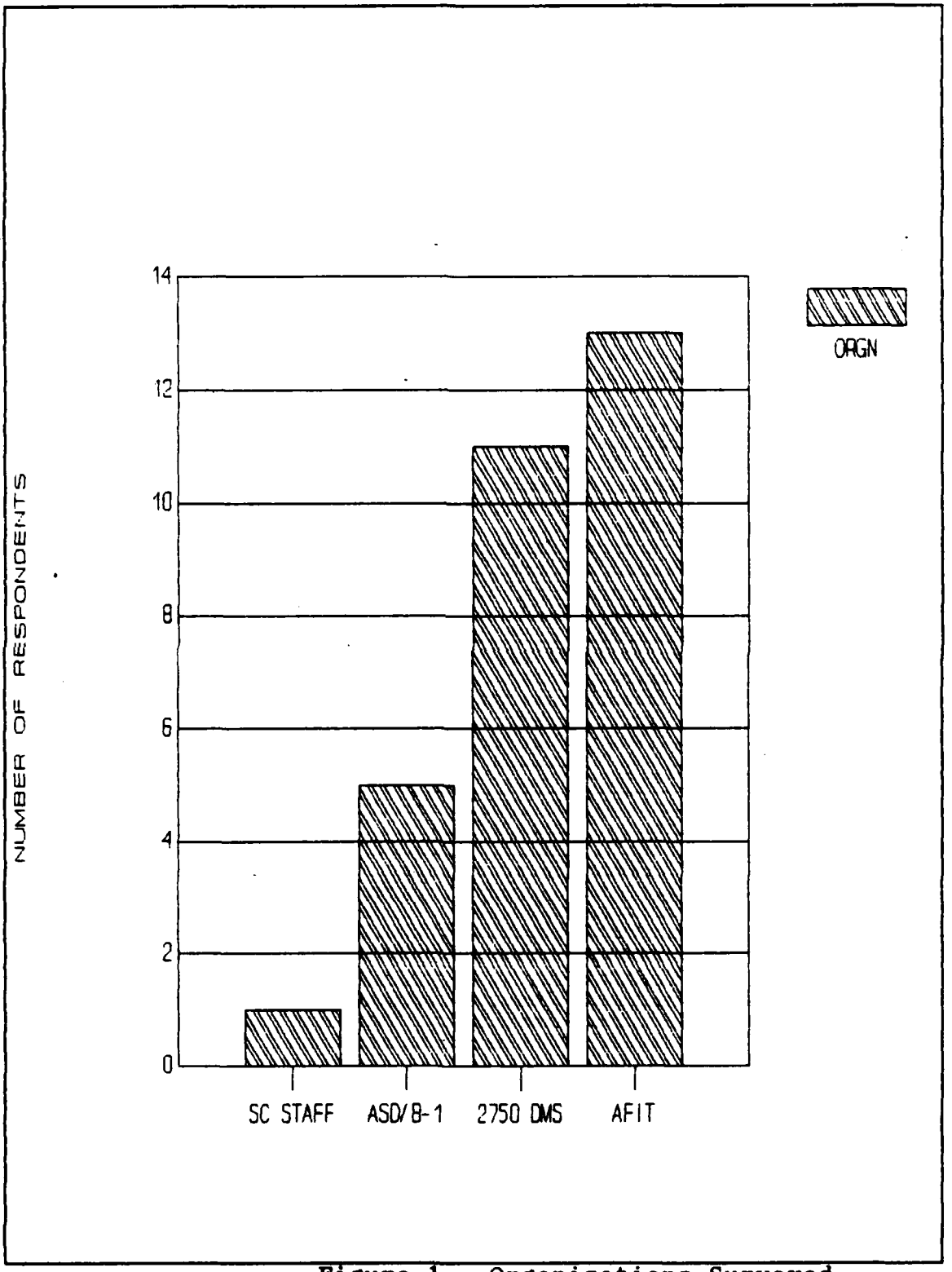

Figure 1. Organizations Surveyed

contains many of the responsibilities that most operational units at wing, group and squadron level may encounter.

A second reason for choosing these organizations was their similarity in the number of personnel assigned. All three organizations were authorized and assigned between 350 and 400 personnel. This factor was useful in determining the variety and quantity of software types that various departments and sections would deem necessary.

The third reason for choosing the selected organizations was the computer hardware configurations involved. All three organizations were heavily involved in automating many tasks through the use of both PCs and mini computers. In addition, they all contained networking capabilities between their mini computers and their PCs. Such configurations called for extensive requirements analysis and strict management and control procedures by communications and computer (SC) personnel.

Types of Personnel Interviewed

The individual interviewed from the ASD ISTC was the manager responsible for PC support within ASD. The 29 personnel interviewed from the three user organizations consisted of 8 individuals classified strictly as managers, 15 users, and 6 individuals which fell into both categories (see Figure 2).

Two primary types of individuals were selected for interviews at each organization. Managers, or those

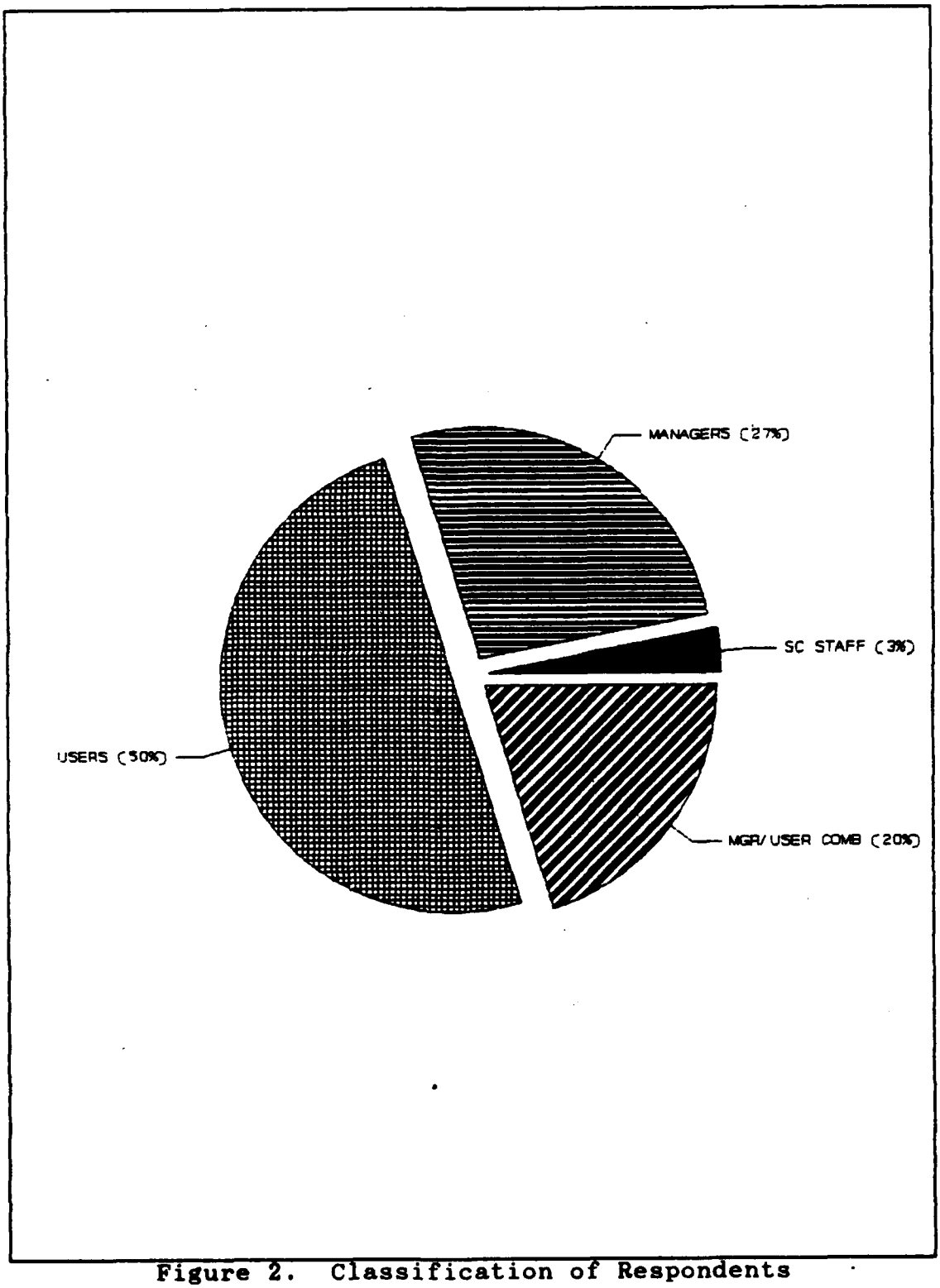

Figure 2. Classification of Respondents

responsible for authorizing the purchase of PC software were questioned, since they could best indicate how they acquired software products. Key PC users were also interviewed, since they could provide a good measure of how effective a given product is at streamlining tasks. Managers were considered to be those individuals who were in charge of their office or department and had authority to validate requirements initiated by their subordinates. Users consisted of key individuals who rely on the use of PCs for the accomplishment of their duties. Individuals who had some decision making authority for software acquisition and who also used PCs for daily tasks were also identified and listed in a separate category (designated "Both"). By grade structure, 13 of the individuals interviewed were officers, 4 individuals were enlisted, and the remaining 13 (including the ASD ISTC individual) were civilian. Finally, individuals were also classified by their general job titles. Figures 3 and 4 provide graphical breakouts of these numbers.

Procedures

To insure accuracy and standardization during data collection, personal interviews were conducted by the researcher at each organization. This method of data collection was selected for several reasons. First, by using personal interview techniques, the researcher was able to explore areas where specific questions were possibly

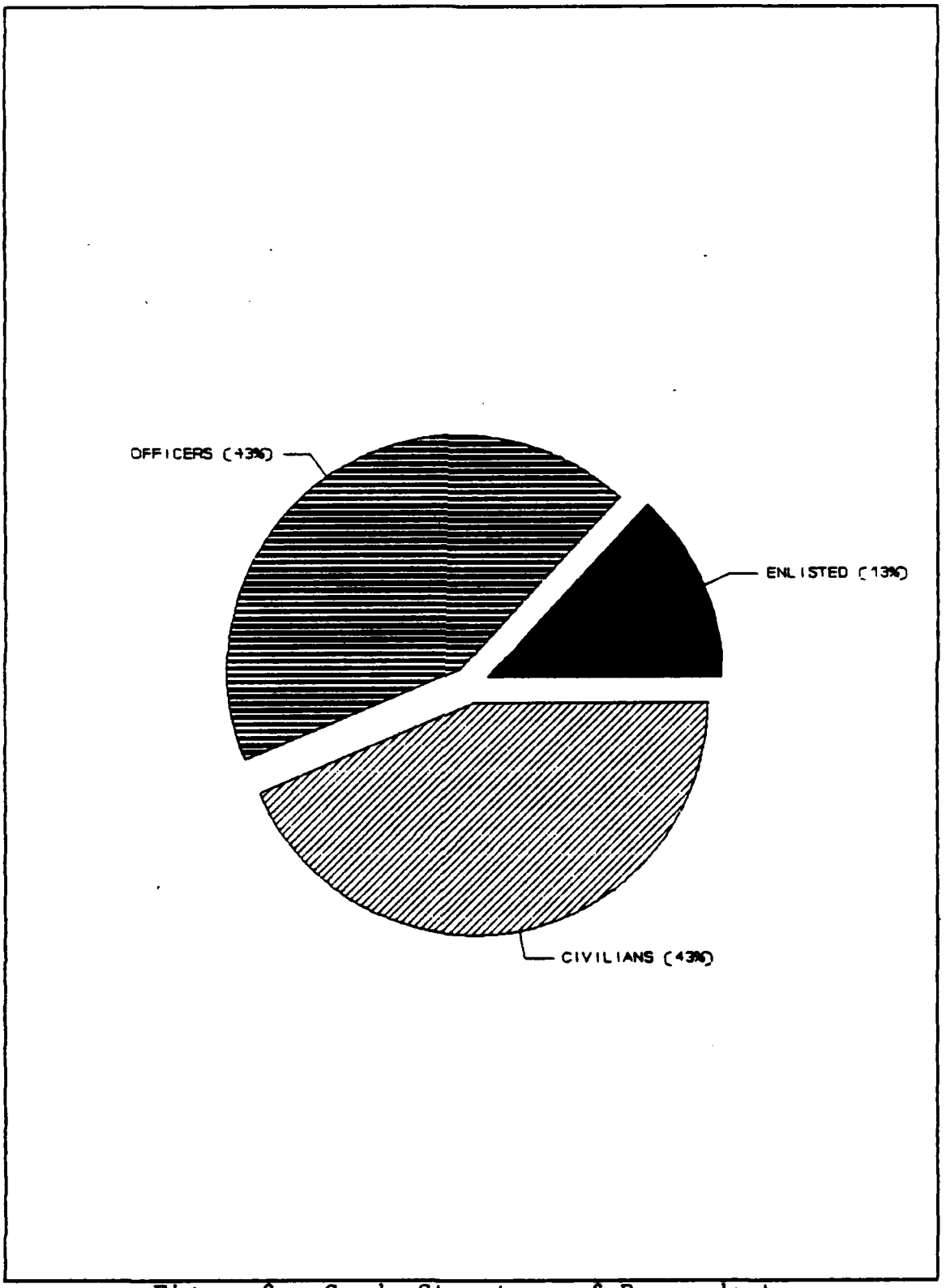

Figure 3. Grade Structure of Respondents

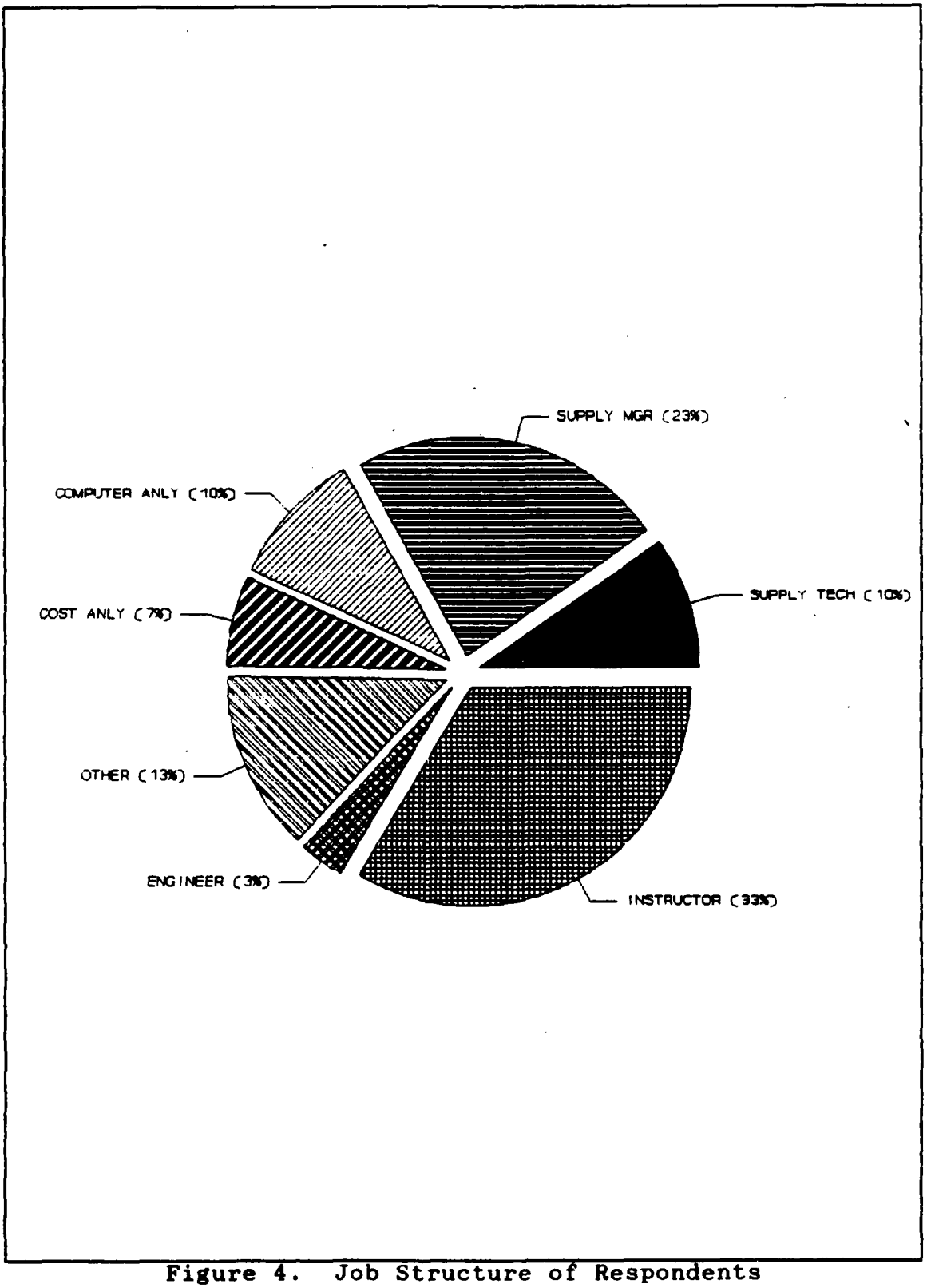

Figure 4. Job Structure of Respondents

difficult to construct in advance (26:289). Since information systems requirements analysis is still a relatively new area of research, answers may not have been as readily defined as they would be in other disciplines. Thus the use of probing and funneling techniques during personal interviews served to address areas not readily apparent to the researcher (26:289). In addition to the above mentioned reasons, personal interviews were also used to allow a greater response rate from the candidate organizations (6).

While some questions required yes/no answers, the primary type of questions asked during the personal interviews were semi-structured. This method was selected so that respondents would not limit their answers to a narrow frame of reference. Also, it was felt that such structure would minimize the possibility of leading respondents to a preferred answer (6).

To minimize the possibility of observer bias, the researcher employed nonverbal interviewing techniques, and also structured questions in such a way as to not elicit biased responses. Interview questions, during preparation, were validated by the Thesis Faculty Advisor and two other graduate professors to ensure their effectiveness, including one in the Department of Communications and Organizational Behavior, and one in the Department of Logistics Management.

Specific Method

The research effort was conducted in five phases. Each phase was designed to answer a portion of the research objectives:

1. The following four types of literature were reviewed:

   a. Literature outlining the feedback process between users and developers of Management Information Systems helped to validate the role of managers and users in determining PC software requirements.

   b. Literature describing personal interview techniques, their validity, and the correct process insured an unbiased approach to conducting the actual survey.

   c. A review of Air Force Regulations and publications describing the current procedure for acquiring PC software helped the author to examine the effectiveness of the current methods.

   d. An examination of other requirements analysis models for Management Information Systems contributed to the development of a proposed model for Air Force use in PC software selection.

2. The survey questionnaire, designed to provide answers to the investigative questions, was prepared in a format understandable by users. Questions were written in a non threatening manner and laid out in a logical sequence (See Appendix 1 for a copy of the survey instrument).

3. Interviews were scheduled through telephone conversations with the respondents. During the telephone conversations, two dates were established. The first session, a five minute interface, consisted of a familiarization of the topic with the respondents and the presentation of the survey instrument to them. They were cautioned not to fill out any portion in advance, with the exception of the list of software products possessed. The second session ranged from 30 to 60 minutes in length, and consisted of the actual data collection interview. At the conclusion of the interview, respondents were asked if they had any additional comments. These

comments were noted and used as additional input in the development of a requirements analysis model. The first interview was conducted on March 18, 1988, and the final interview was conducted on June 4, 1988.

4. Concurrent with the development of the survey questionnaire, a data base was also designed for the purpose of sorting responses by various categories related to the investigative questions. As each interview was completed, the information was transferred to the database (see Appendix 13 for a description of the Q&A Data Base Management System and it's use in this project).

5. Once all interviews were completed and all data was entered into the data base, reports were developed and generated to facilitate answers to the investigative questions and provide the descriptive information mentioned above. The following reports were compiled:

   a. Types of Guidance Obtained

   b. Types of Software Used

   c. Critical Software Products

   d. Users of the Software

   e. How Products Were Acquired

   f. How Software Needs were Determined

   g. Software Task Analysis

   h. User Satisfaction

   i. Product Comparison

   j. Perceived Weekly Usage

   k. User Comments

Summary

The methodology described in this chapter was developed for the purpose of determining the adequacy of current PC software requirements analysis methods, and to develop a

better method if the current practices proved insufficient. The steps used to conduct the study were necessary to insure a reliable and valid approach. Using the data collected along with the literature reviewed, the normative, descriptive, and proposed requirements analysis models were developed, and will be presented in the next chapter.

IV. ANALYSIS AND DISCUSSION

Overview

The purpose of this chapter is to present the results of the interviews and use these results to develop a descriptive model of PC software requirements analysis. The normative model was also developed from the review of literature and compared against the descriptive model. From these two models, a proposed model is presented.

Findings

Guidance Received. Respondents were asked what type of guidance, if any, they sought before acquiring software for PCs. Two types of guidance; consultant or staff assistance, and published guides or journals were of interest. Figures 5 and 6 provide a breakdown of the sources users referenced.

Although regulations suggested that users obtain assistance from the local SCTC or communications unit, the most sought after sources for assistance were other users, followed by SCTC guidance and third, vendor consultants, for software selection. Under written or published assistance, almost half the users turned to either popular magazines or no guidance at all, despite the availability of regulations and SCTC policy letters. Thus, the two major sources of guidance for software selection appeared to be other users and popular journals.

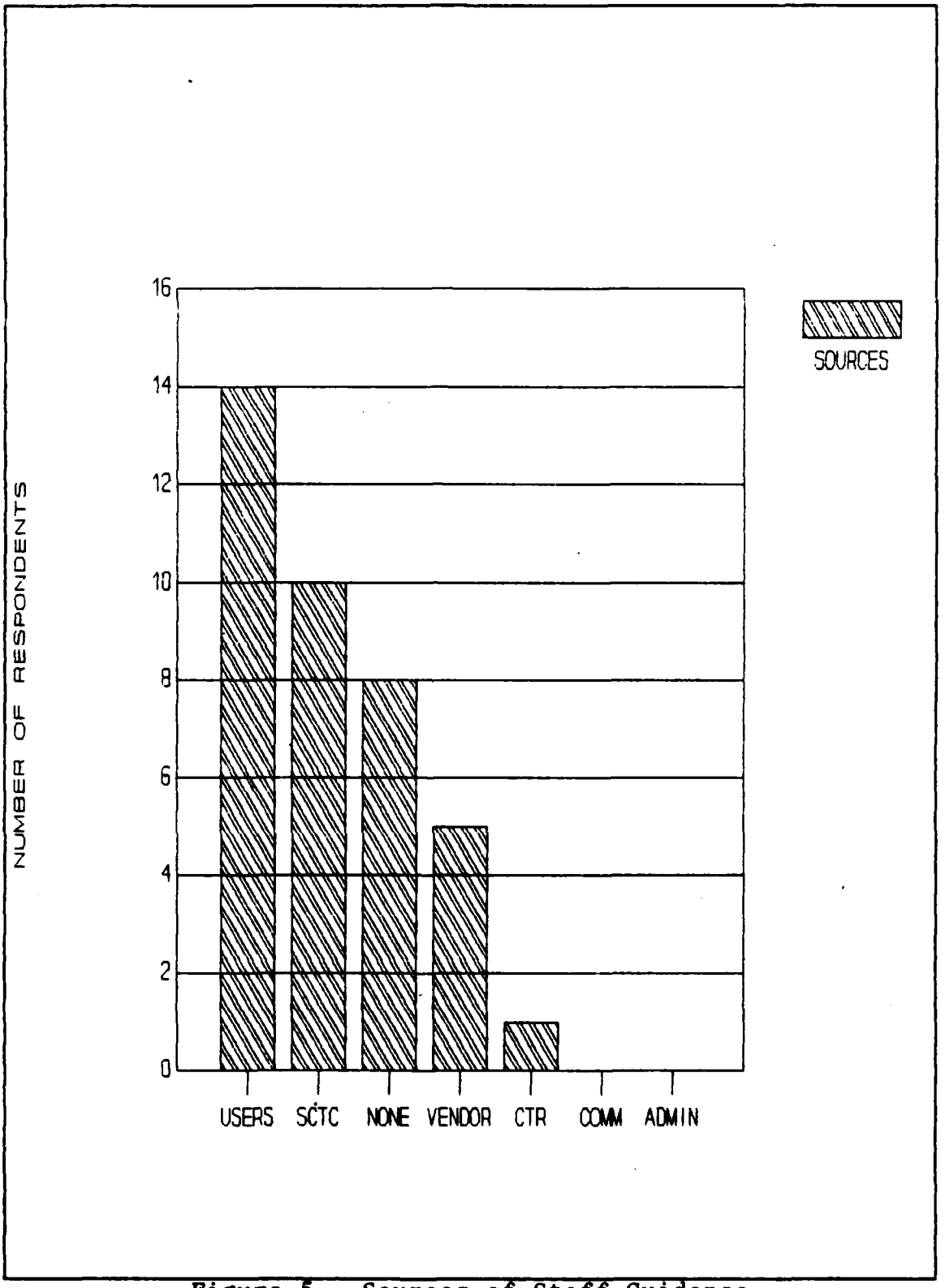

Figure 5. Sources of Staff Guidance

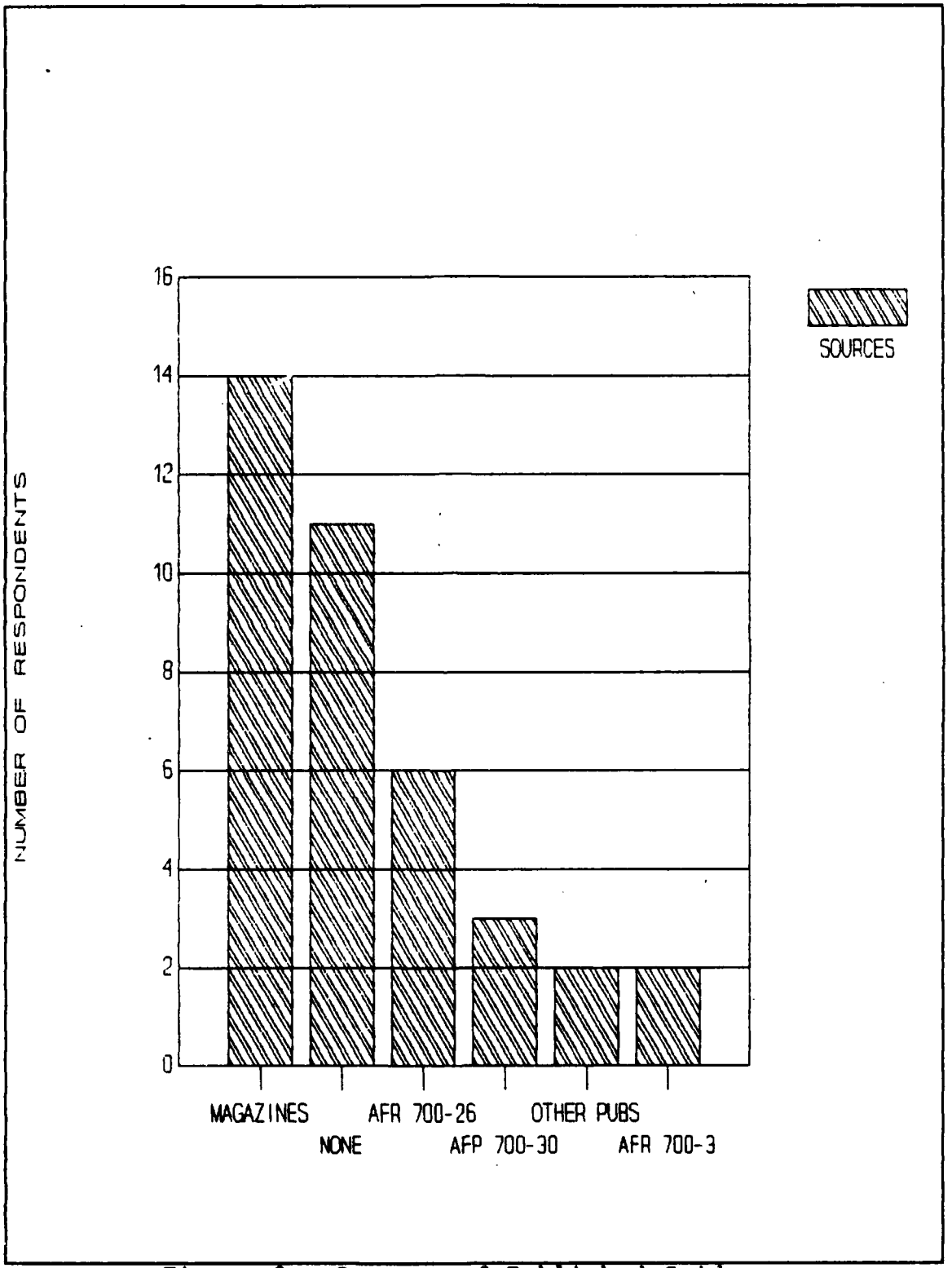

Figure 6. Sources of Published Guidance

Types of Software/Cost. Although respondents were asked to provide a list of software used by their offices, this task proved to be difficult to fulfill for a number of reasons. First, most offices did not keep an inventory of software authorized on their systems (such practices had just begun to be implemented at the time of the interviews). Besides a lack of documentation, several versions of the same commercial software products were available within the organizations and were residing simultaneously on some machines. Second, some respondents admitted to bringing in privately owned software to accomplish mission tasks on the government PCs. Because of these factors, the software inventories conducted for this study could not be validated as accurate. However, software products which were used or residing in each office were noted. Cost figures for the products were obtained either from the individuals or from the Standard Small Computer Contract. Appendix 2 lists the software products residing on PC systems by organization and office. Eleven different types of communications packages, 12 data base management systems, 6 graphics packages, 12 programming languages, 5 project management systems, 8 spreadsheet systems, and 10 word processors were among the various types of software products owned or used by the organizations and offices. Prices for the products ranged from no cost for public domain packages to $5000.00 for some data base management systems.

Critical Software Products. Since a myriad of software products were residing on the PC systems, respondents were asked to list their three most critical products in order of importance. Critical products were defined to be the top three software products depended upon most often by respondents and other individuals in their offices. Appendix 3 provides a breakdown of critical products by software type category, software products, individual ranking (1, 2, or 3), and by offices within each organization. Figure 7 displays the software categories designated critical or in the top three. Clearly, graphics packages were depended upon the most for office tasks, followed by spreadsheets and data base management systems. Word processors were a surprising third, followed by integrated packages, which consisted of software which provided a combination of graphics, spreadsheet, data base management, word processing, and communications capabilities within one product. These findings differ slightly from a study by Lee of business organizations using PC software (14:316). In his study he identified spreadsheets as the most critical software type, followed by word processors, programming languages, data base management systems, and graphics. These differences may be attributed to a number of factors. First the sample size of the present study was much smaller than Lee's. Second, over the past two years, more sophisticated yet more user friendly packages have been

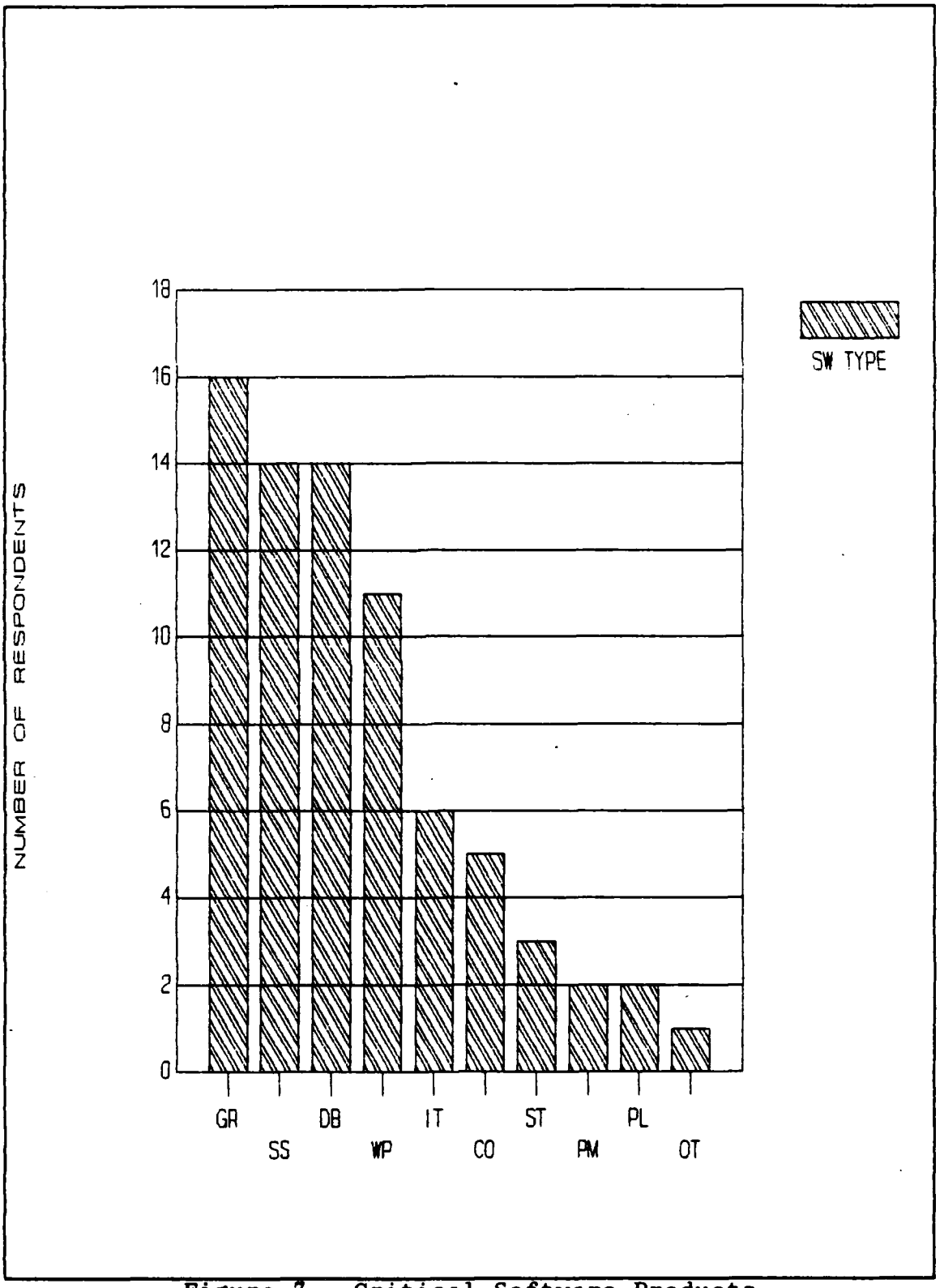

Figure 7. Critical Software Products

developed, making them more attractive to users. This has been the case in the five software types selected by respondents in this study.

Users of the Software. Respondents were asked to state the primary users of their critical software packages. Appendix 4 lists by category the software types, the specific products, and primary users. Data gathered for this question was unclear, however, since most respondents provided vague answers. As such, many of the responses included "everyone" as primary users. The researcher was able to distinguish some categories of users by looking at the missions of the various offices and determining the job classifications. Based on these factors, Figure 8 provides a breakout of primary users for the most critical software types and products.

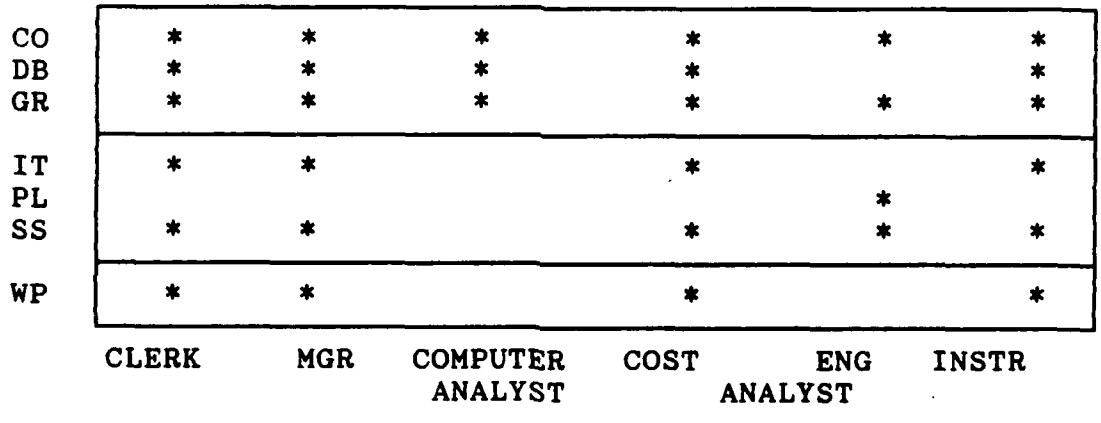

Figure 8. Primary Users of Software

Technical/clerical personnel, managers, cost analysts and instructors all were indicated as primary users of communications packages, data base managers, graphics packages, spread sheets, word processors, and integrated packages. Computer analysts and engineers had different primary packages, but this was expected based on the narrower scope of their duties and the small number surveyed.

How Software Products were Acquired. Five main sources mentioned for acquiring critical software included the Standard Small Computer Contract, sole source or special purchase actions, the use of a contract negotiated by ASD SCTC with software distributors, vendor provided copies of software (for evaluation and comments), and self purchase. Figure 9 provides a chart showing the most used sources. Appendix 5 provides further details of this information by software type, product name, and unit.

Although Air Force regulations dictate the use of the Standard Small Computer Contract for the majority of software acquisitions, in practice only slightly more than a quarter of the users acquired critical software through those means. The ASD contract was a modification of the sole source method. Combining the sole source and the ASD software methods together resulted in 36.7% of all critical software products purchased by special justification.

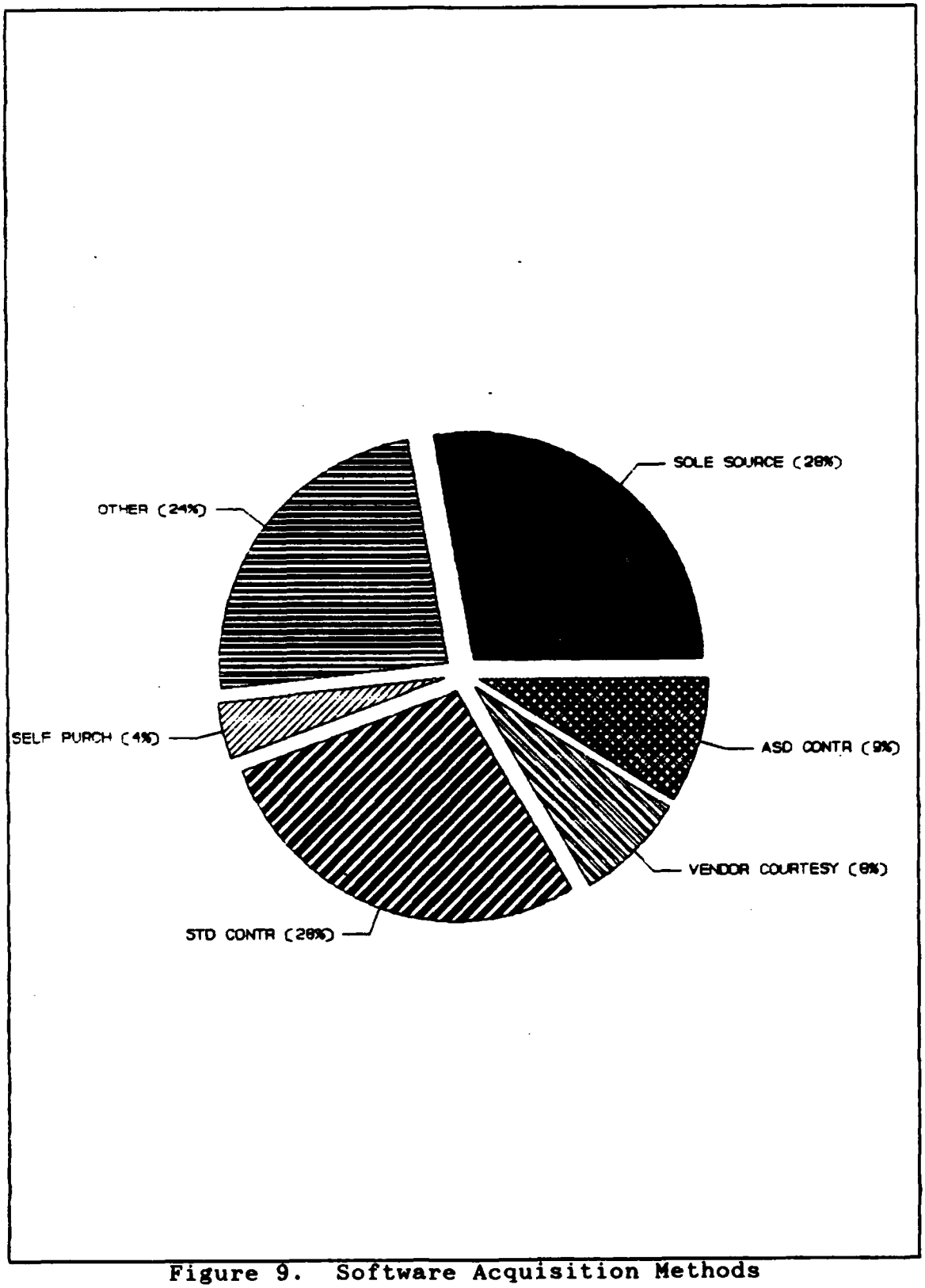

Figure 9. Software Acquisition Methods

How Software Needs were Determined. Respondents were asked to state how they determined the need for the critical software packages they were using. The intent of this question was to determine if any requirements analysis techniques were used prior to purchasing the software. No users employed the formal techniques described in Chapter II. However, users did find requirements for software based on the need to accomplish six knowledge work tasks, and four qualitative factors. The knowledge work tasks included authoring and presentation, planning and decision support, monitoring and control, organizing and scheduling, diagnosis and problem finding, and communication. The qualitative factors included interoperability and transportability of data between PCs, mainframes and other software types and products, evaluation through demonstrations or periodicals, cost considerations, and other factors such as downwardly mandated software product purchases. Figures 10a and 10b display the number of products (by software categories, knowledge work categories, and qualitative categories) that underwent a needs analysis. Appendix 6 provides a more detailed breakout of the information.

The data indicates that users saw a strong need for authoring and presentation tasks as well as interoperability and transportability of the information. However, in almost every case, users did not perform an evaluation before acquiring the software. Rather, they acquired the software

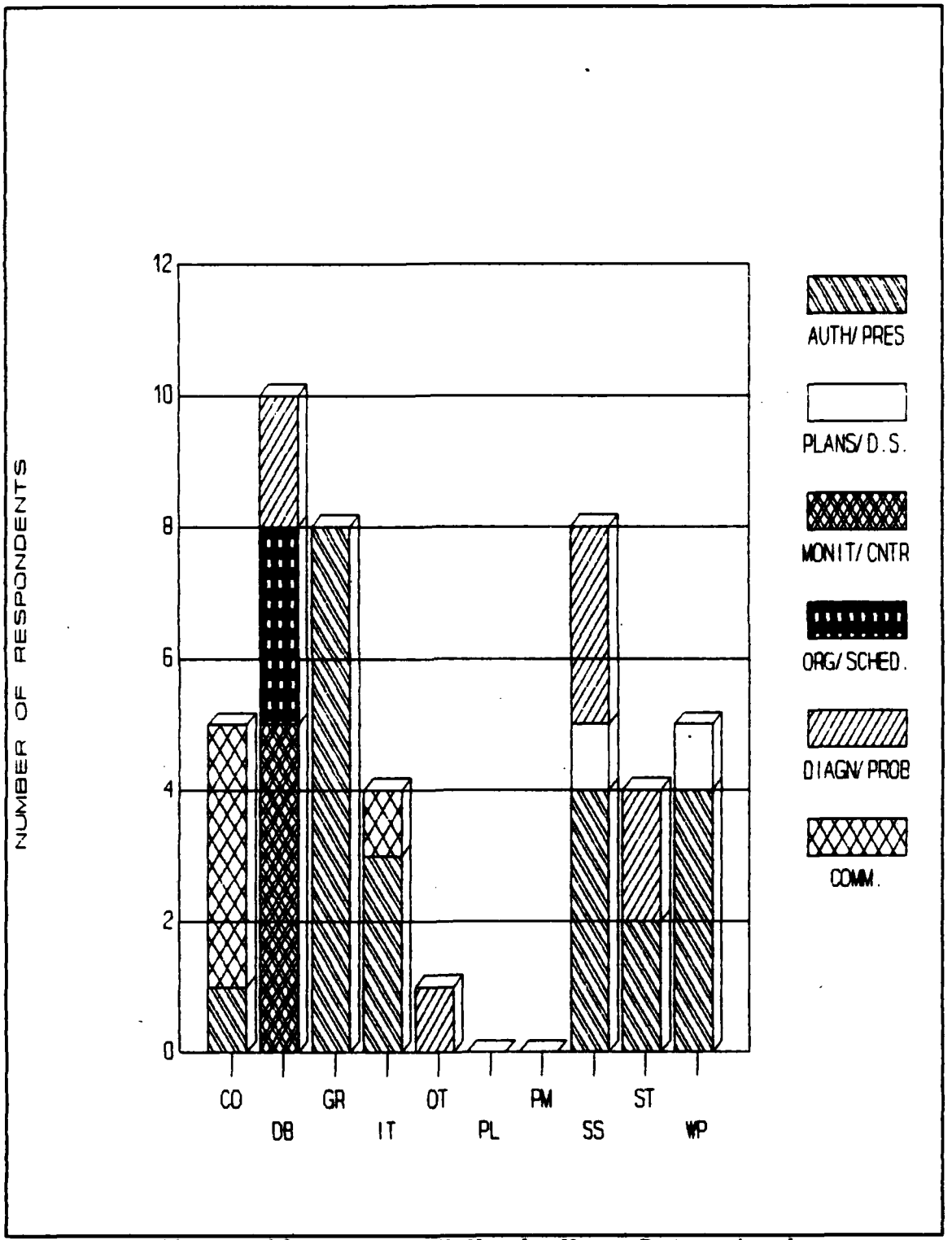

Figure 10a. How SW Needs Were Determined

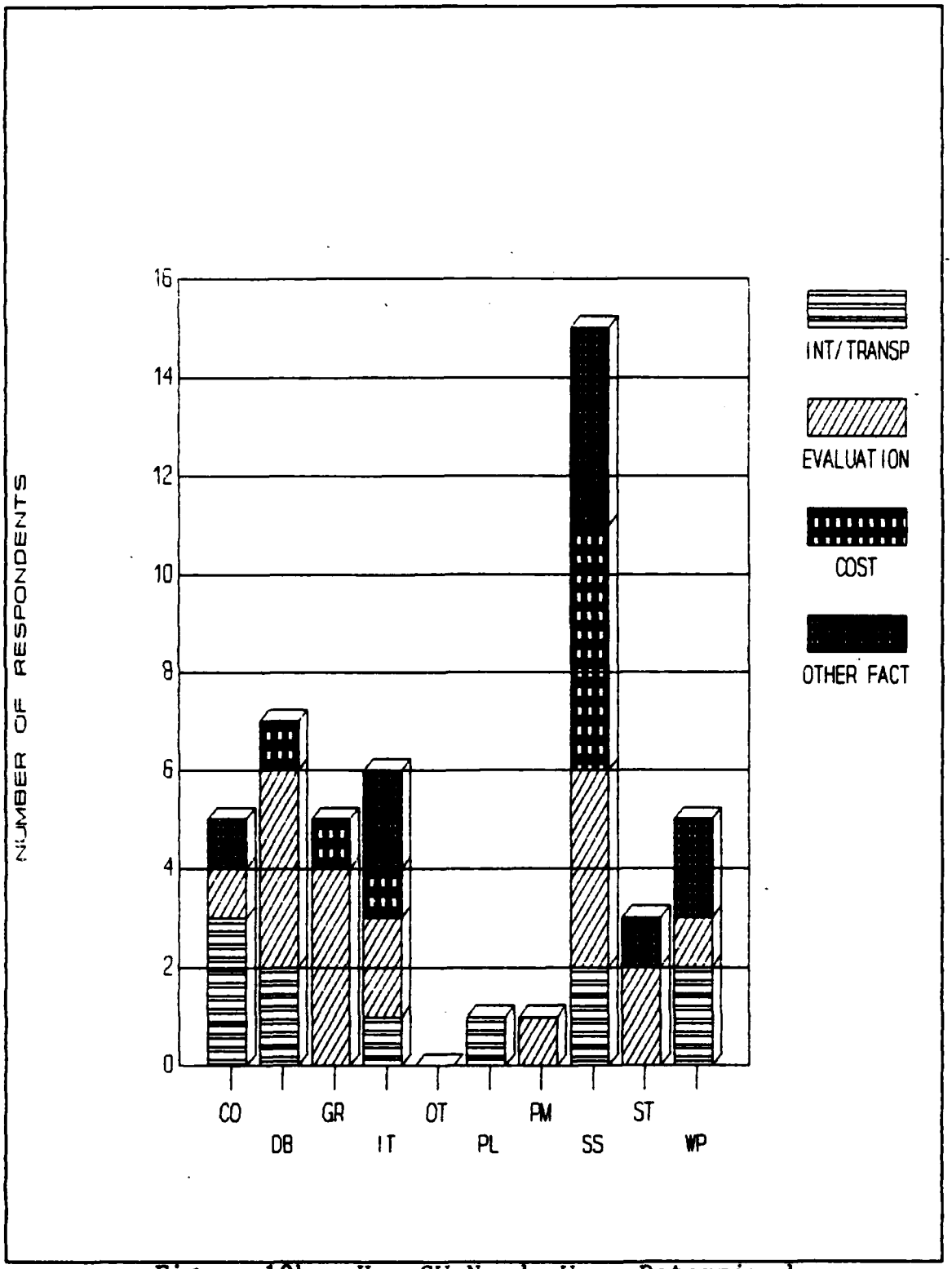

Figure 10b. How SW Needs Were Determined

first and determined the need as they became comfortable with the software products.

Software Task Analysis. Respondents were asked to detail the tasks they intended to simplify with the software, and correspondingly, provide a breakdown of the tasks which were in fact streamlined and which ones were not. Figures 11a through 13 provide a breakout, in numbers, of the results. In addition, Appendix 7 shows a more detailed description of the same information. Clearly, the majority of knowledge work tasks addressed included authoring and presentation, monitoring and control, and diagnosis and problem finding. Software types used to satisfy these requirements included data base management systems, graphics packages, spreadsheets, word processors, and integrated packages. In addition, the need to accomplish interoperability and transportability of the information was also identified and satisfied.

User Satisfaction. Since most of the tasks intended for streamlining were accomplished by the critical software products, one would expect the users to be satisfied with the products. Such was the case, with very few exceptions (see Appendix 8). The few areas where users had not been able to satisfy requirements included communications, interoperability and transportability of information, and authoring and scheduling. In these instances, users felt disatisfied with the software's performance. The

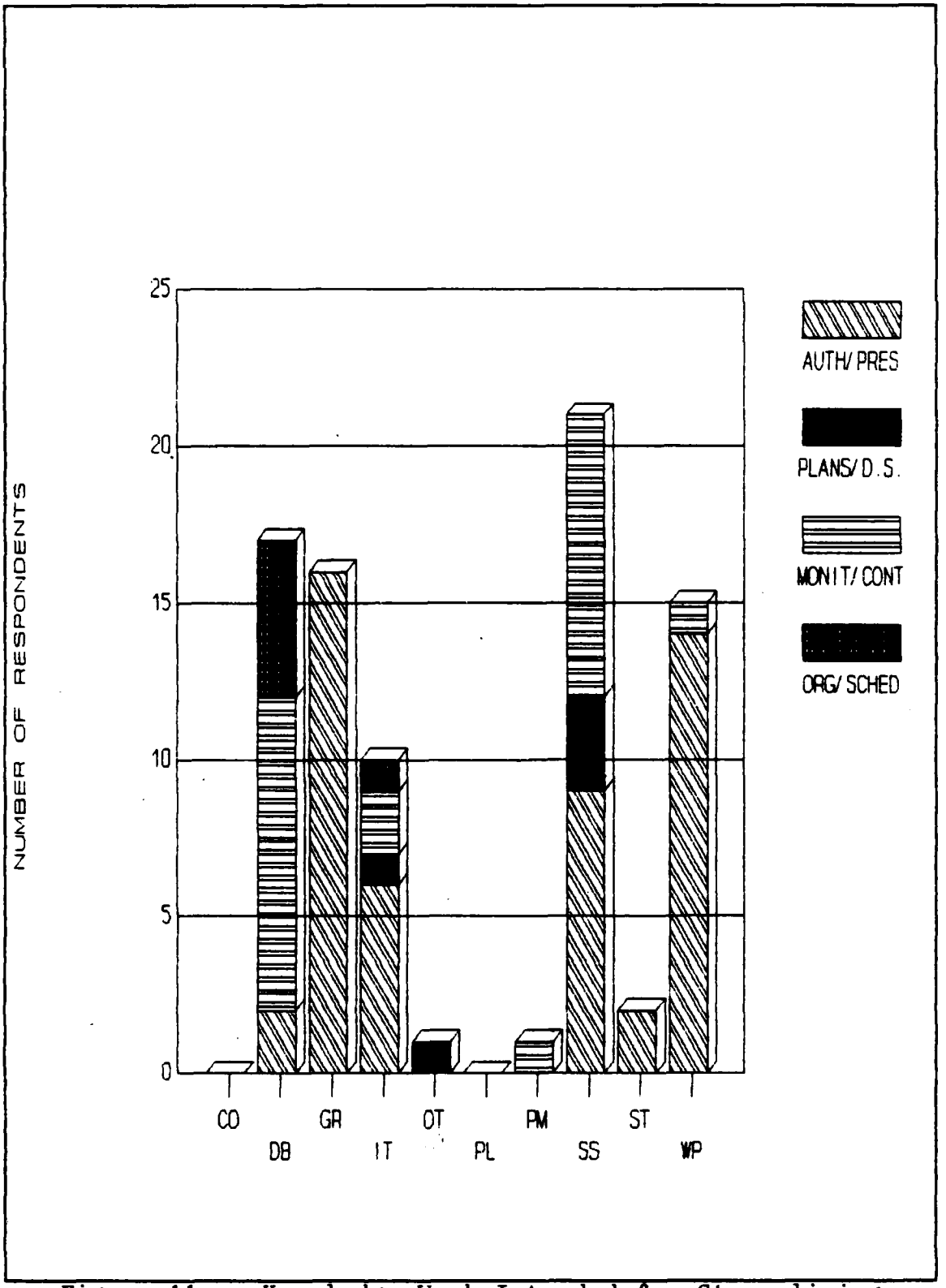

Figure 11a. Knowledge Work Intended for Streamlining

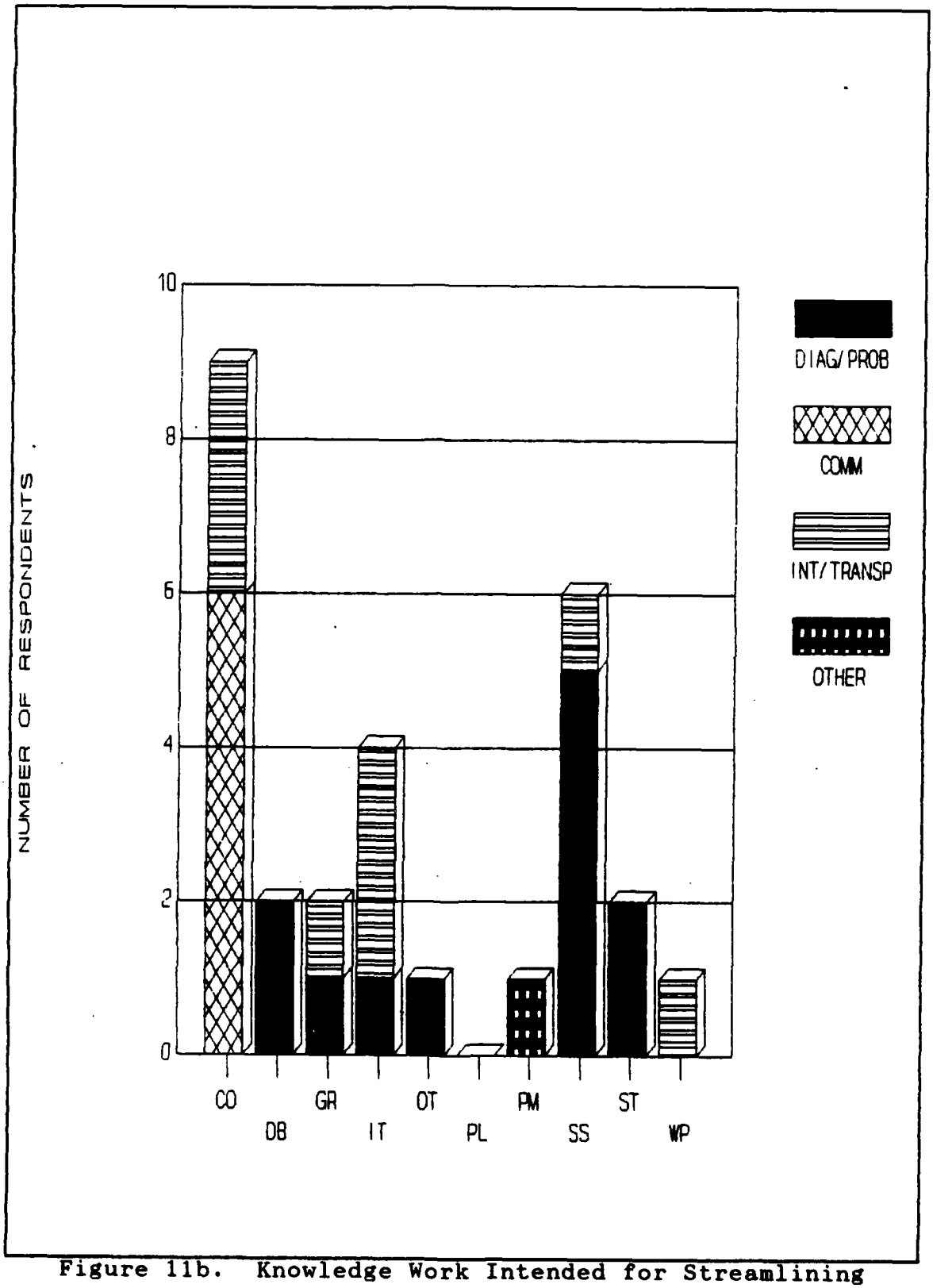

Figure 11b. Knowledge Work Intended for Streamlining

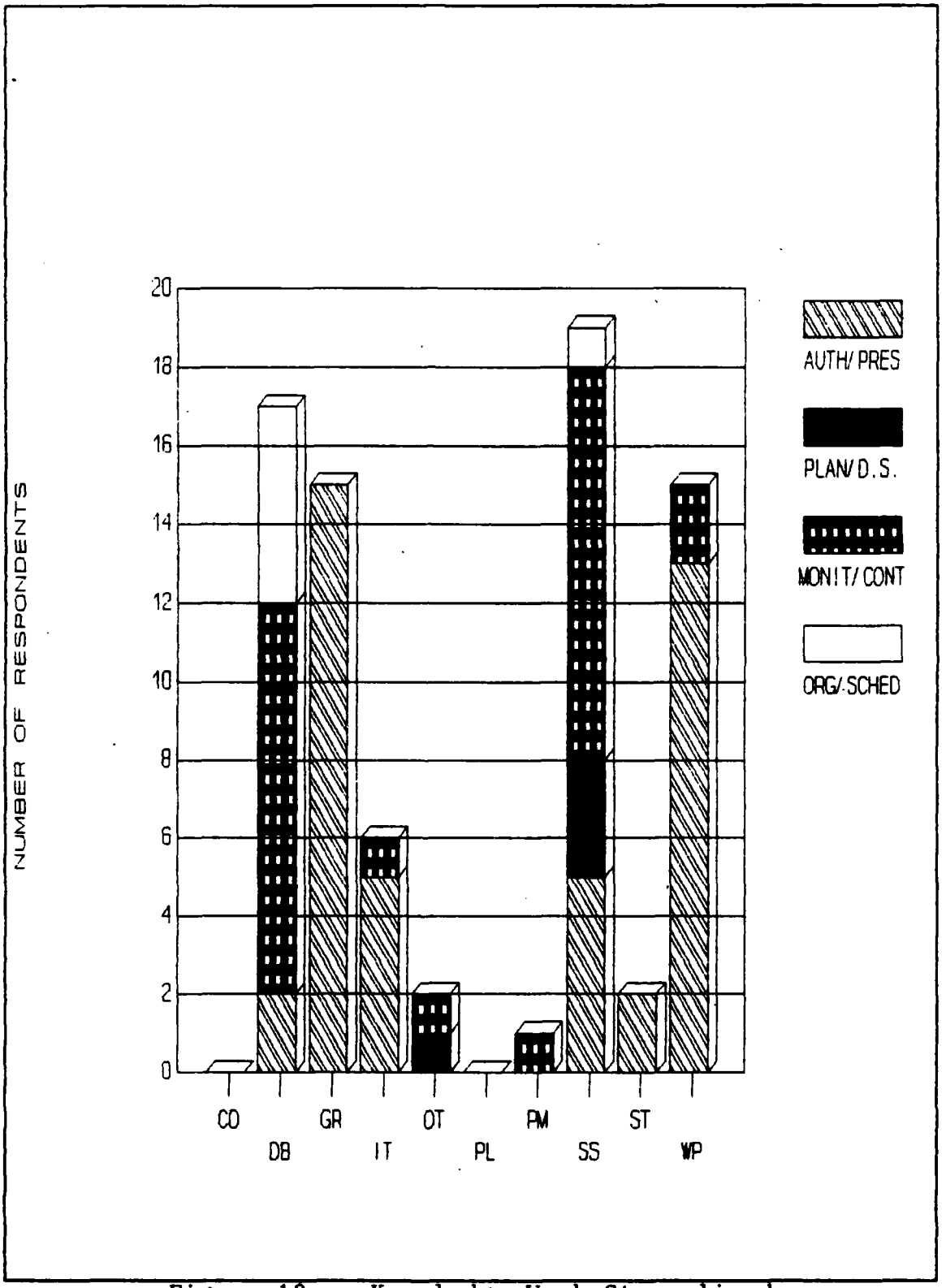

Figure 12a. Knowledge Work Streamlined

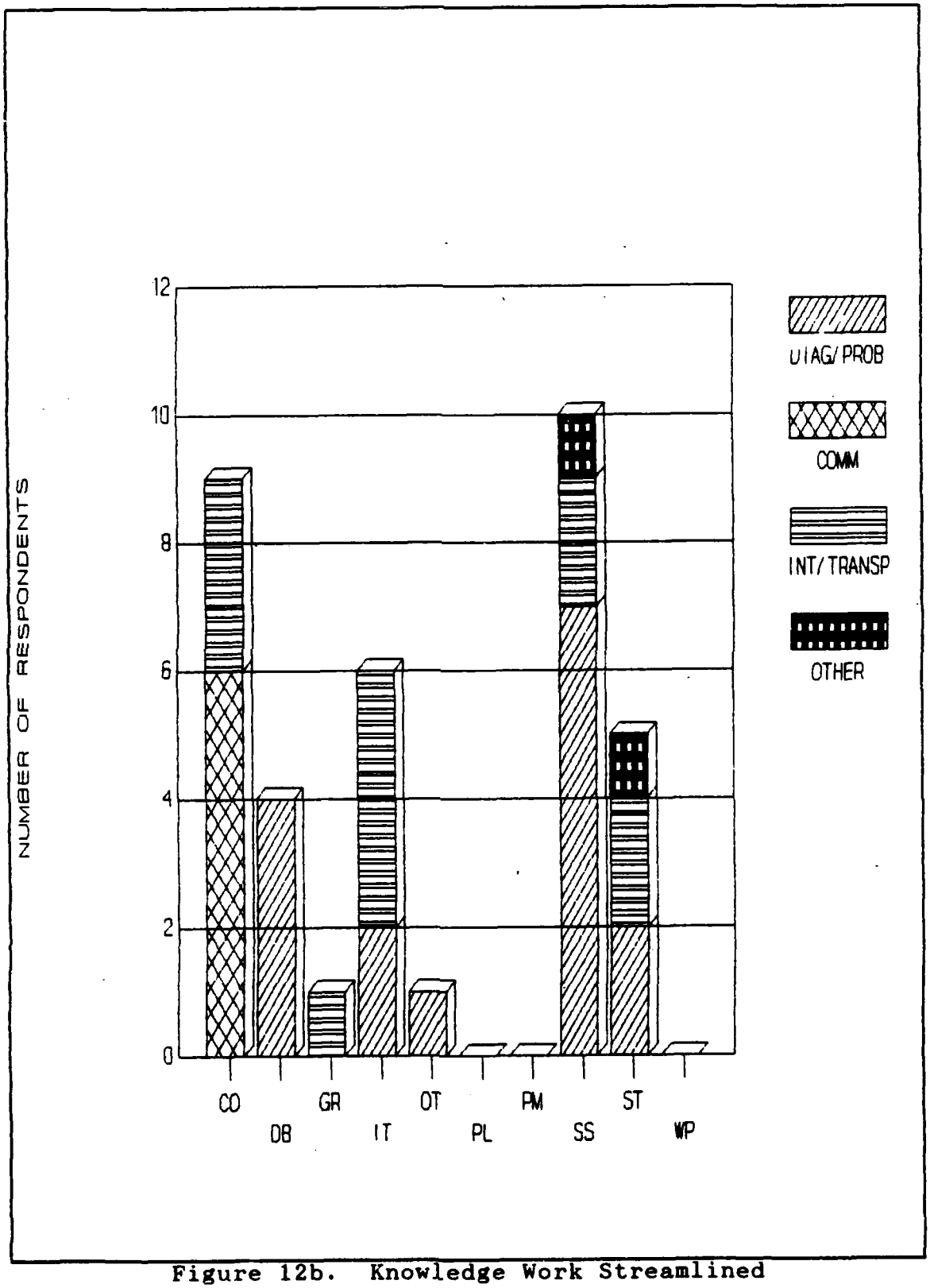

Figure 12b. Knowledge Work Streamlined

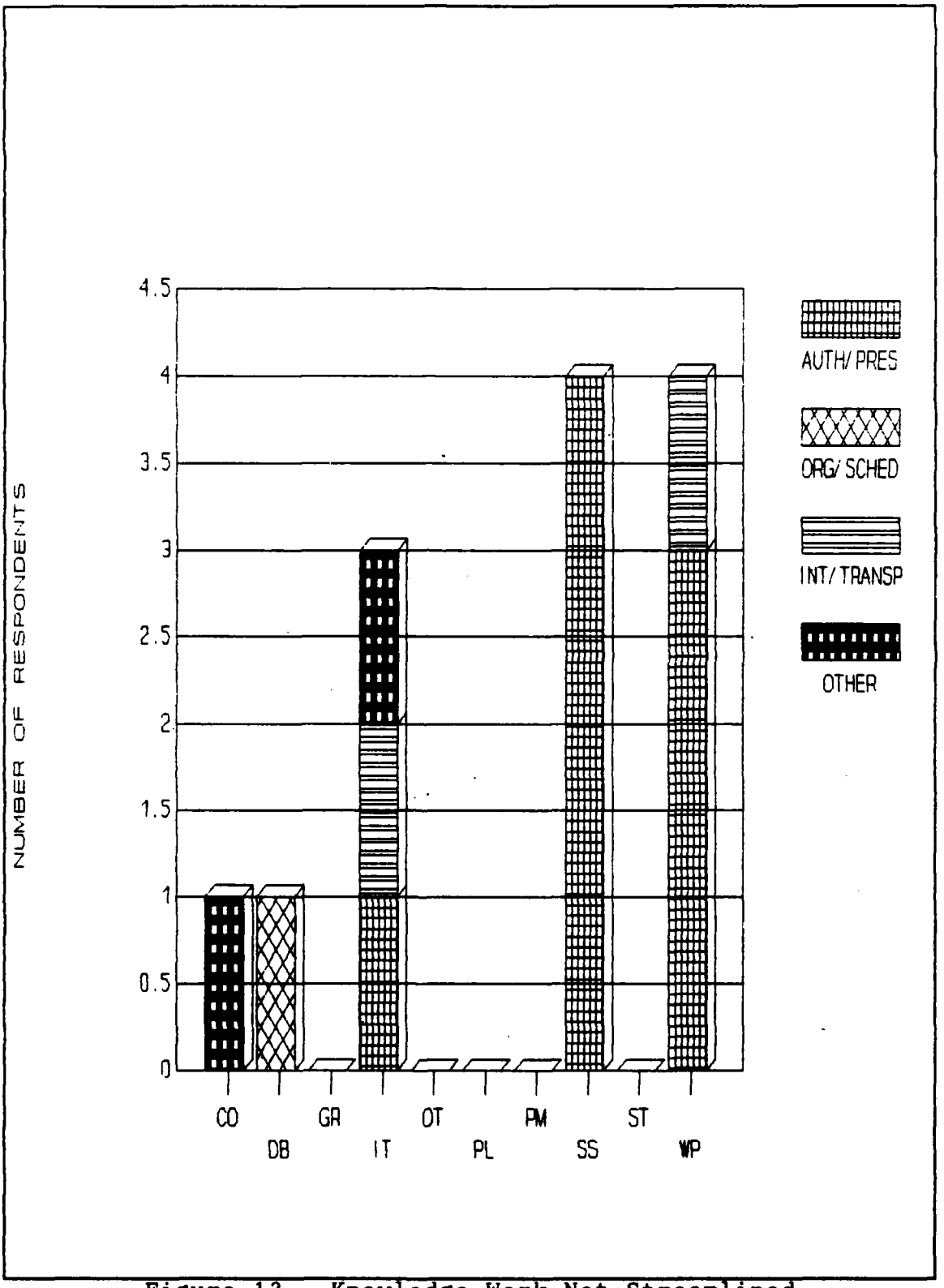

Figure 13. Knowledge Work Not Streamlined

products in each of those categories which did not meet the users' needs included MS-Kermit, Procomm, and ZStem (communications), Ability and Enable (interoperability and transportability), and Wordstar (authoring and presentation).

Product Comparison. Respondents were asked if they considered using other software types or products to accomplish the intended tasks. In most cases, they did not perform any type of detailed comparison (see Appendix 9). Of the few comparisons which were performed, almost all users looked only in the same software type category, comparing spreadsheets against other spreadsheets, for example. Only one user determined that a different software type would better satisfy the requirements. That user chose to take tasks which were presently being accomplished using a spreadsheet for personnel management (monitoring and control) and transfer the information into a data base management system.

Frequency and Duration of Software Use. Respondents were asked what daily (D), quarterly (Q), and annual or non recurring tasks (Y) were performed using the critical software products (see figure 14). They were also asked to estimate the number of hours each product was used on a weekly basis. Appendices 10 and 11 list the responses. In addition, daily, quarterly and annual tasks were categorized into the knowledge work fields by software type.

	AUTH/PRES	PLAN/D.S	MONIT/CTRL	ORG/SCHED
CO	D			D
DB	Q,Y		D,Q	D
GR	D,Q,Y		Q,Y	
IT	D,Q		D,Q,Y	D
OT				
PL				
PM			D,Q	
SS	D,Q,Y	D	Q	D
ST				
WP	D,Y		Q	

	DIAG/P.S	COMM	INT/TRANSP	OTHER
CO			D	
DB	D			
GR				
IT	Q,Y			
OT				
PL				
PM	Q		Q	D,Y
SS	D,Y		D	D
ST				
WP		D		

Figure 14. Frequency and Duration of Use of Software Products

Communications, data base management systems, graphics, integrated systems, spreadsheets and word processors were used continuously, mainly for authoring and presentation, monitoring and control, and diagnosis and problem solving.

User Comments. Respondents were asked if they would like to provide any additional comments to provide input into the study. Twenty individuals provided comments, which are listed in Appendix 12. Six areas drew repeated remarks, and are mentioned below.

Software Purchases. Users felt that purchasing software at the same time as the hardware procurement was much easier than purchasing software at a later date. Specifically, justifying software alone was considered a very tedious task which required extensive amounts of user research and great risk of disapproval by SC requirements committees. Consequently, users would buy as much software up front as possible, then determine needs for the software at later dates. This resulted in vast amounts of unused software residing in PCs or in office shelves.

SC Staff Support. The aforementioned "buy now, justify later" attitude of many users was a result of a feeling that the SC staff did not provide enough support for users of PC based systems. Some users wanted the SC staff to play a greater role in helping users determine their requirements. Conversely, some users wanted more autonomy

in selecting specific software products. Specifically, oncestaff assistance enabled users to determine what type of software application should be used to accomplish the defined knowledge work requirement, users wanted the authority to select their own software product. At the present, many felt they were restricted to using only software listed on the Standard Contract.

c. Training was insufficient for most of the software available on the Standard Contract. Users felt they could get more productivity out of the software if they were able to obtain or provide training for more of the personnel in their offices. While classroom training was available for many of the packages, the waiting list was long, and the duration of the training was considered too brief to provide immediate productivity.

d. Users wanted to see more software which could be compatible with other applications and products. In some instances, users were mandated into using certain packages, but saw a need to obtain other products so they could be compatible with their customers. The SC solution to the problem of software incompatibility was to attempt product standardization. Users suggested, however, that interoperability and transportability of data between applications and between products would result in greater productivity and still maintain user autonomy.

Hardware Availability. Software use, in some instances, was limited by the availability of hardware systems. While users had a definite need for automation of knowledge work, an insufficient number of systems were provided for use. As such, the software may have been under-utilized, not because of a misstated need, but because of poor configuration of systems.

Standard Contract. Software on the Standard Contract was not keeping pace with the commercially available products. In some instances, newer, more powerful, more user friendly, and less expensive applications were discovered by users, but not allowed for purchase. In addition, there were no provisions on the Standard Contract for purchasing upgrades to previously acquired products.

Discussion

From the information gathered, a definition of the normative or prescibed method, and the descriptive or actual method of acquiring PC software can be developed. While both systems have merits and problems, they proved to be useful in developing a proposed model as well.

The Normative Model. The driving factors behind acquiring PC hardware or software were the identification of ways to increase the probability of mission success or ways to decrease the cost of mission support (9:1). Based on these criteria, the prescribed methods of determining both

software and hardware requirements are identical:

a. Conduct an Information systems Requirements Analysis.

b. Identify requirements which cannot be satisfied by existing methods.

c. Record the unsatisfied mission requirements.

d. Record current costs of not satisfying those mission requirements.

e. Consult the SC staff for a technical solution.

f. Prepare an SC Requirements Document (9:33).

g. Obtain SC Requirements Board approval for purchase of the PC system and software.

1. Table of Allowances (T/A) 007 and 009 are the primary sources for requirements for standard small computers.

2. The MAJCOM SCTC recommends acceptable software for the stated/approved requirements.

3. If the SCTC cannot provide the required software the user may obtain the software through the Standard Contract. If the software is not available on the Standard Contract, the user may identify commercially available software, and develop a sole source justification to purchase that software [8:4].

From the viewpoint of most users, the problem with the normative model was the inability of the SCTC or the SC staff to define an appropriate technical software solution for stated mission requirements. Users were dismayed with choices of software available on the contract, and were not provided enough guidance on which products to acquire. Although they were restricted primarily to the software available on the Standard Contract, information gathered

indicates they were able to order as many types of software as they, not the SC staff, deemed necessary. The normative model was lacking in its ability to assist users in specifying the appropriate software for their stated knowledge work tasks.

The Descriptive Model. The way organizations decribed their acquistion process differs greatly from the prescribed approach. Users, as a rule, did not identify requirements before acquiring software. The method was generally as follows:

a. Identify software products and their applications through three main sources:

    1. Other users.

    2. Popular magazines

    3. Commercial vendors, demonstrations, and evaluations.

b. Determine organizational requirements which may be streamlined by the use of the software.

c. Justify the requirement for the product, mainly through sole source means versus Standard Contract sources.

d. Acquire the product upon SC Requirements Board approval.

e. Discover further office applications through the continued use of the product.

The benefit of this method lies in the ability of users to discover new methods of simplifying tasks without relying on SC personnel, which users have felt were unresponsive (Appendix 12: User Comments). The main problem rested with improper solutions to office tasks through the purchase of

an inappropriate software product. No barriers existed to prevent users from trying to apply spreadsheet solutions, for example, to data base management specific tasks.

The Proposed Model. The proposed model takes issues identifed throughout this study into consideration, and incorporates a method by which users may be able to define, justify, and satisfy their software requirements with the right software tool. The key to the model is the development of a table showing the knowledge work tasks most used by the respondents (Table 1). Software types are recommended based on the knowledge work identified. The steps are as follows:

a. Identify the mission.

b. Model the flow of information through the organization using techniques such as the following:

   1. AFP 700-30.

   2. Data Flow Analysis.

   3. SADT.

c. Identify critical tasks or outputs which must be satisfied to meet mission requirements.

d. Identify inputs to those critical outputs.

e. Identify areas where bottlenecks occur in the information flow.

f. Identify bottlenecks which cannot be streamlined through existing methods.

g. Of those bottlenecks which cannot be streamlined through existing methods, identify the ones which can and should be automted to streamline the flow of information.

Table 1. PC Software Requirements Analysis Model

	AUTH PRES	PLAN D.S.	MONIT CTRL	ORG SCH	DIAG P.S.	COMM
SEND & RECEIVE FINISHED REPORTS	CO WP					CO
PREPARING DATABASE GENERATED REPORTS FOR PRESENTATION	DB WP					
PREPARING SPREADSHEET GENERATED REPORTS FOR PRESENTATION	SS GR WP					
ADMINISTRATIVE CORRESPONDENCE	WP					CO WP
TASK INTEGRATION	IT	DB WP GR	DB WP GR	DB WP GR		CO IT
PERSONNEL MANAGEMENT		DB	DB	DB		
PROJECT MANAGEMENT		DB WP GR IT		DB	DB SS	
COST ANALYSIS	SS GR	SS	SS	SS		
FORECASTING		SS				
SENDING AND RECEIVING SUSPENSES VIA ELECTRONIC MAIL			CO WP			

Table 1 (Continued). PC Software Requirements Analysis Model

	AUTH PRES	PLAN D.S.	MONIT CTRL	ORG SCH	DIAG P.S.	COMM
INVENTORY MANAGEMENT	DB WP		DB	DB		
FILE MANAGEMENT				DB		
STATUS REPORTS	DB WP		DB			
SUSPENSE TRACKING			DB			
BUDGET STATUS REPORTS	SS WP		SS			
PREPARING CHARTS FOR PRESENTATIONS AND REPORTS	GR WP					
BUDGETING	SS GR	SS		SS		
PREPARING PERSONNEL ROSTERS	WP			DB		
TREND ANALYSIS					SS	
SENSITIVITY ANALYSIS					SS	
PC-TO-PC CONNECTIVITY						CO PL
PC-TO-HOST COMPUTER CONNECTIVITY						CO PL

h. Categorize the bottlenecks into knowledge work tasks.
    i. Using Table 1, determine the type of software which would best satisfy the knowledge work.

j. Evaluate the following qualitative factors before purchasing the software:

    1. Cost.

    2. Compatibility with hardware and other software products in the same software category.

    3. Interoperability and transportability of information between different applications (Can the product import and export files to and from the popular data base management systems, Word processors, communications packages, spreadsheets, and graphics packages?).

    4. Legality of use (if the product is public domain or shareware).
    5. Ease of use.
    6. Necessity for or availability of training in the use of the software.

k. Purchase the software and perform evaluations on the actual use as well as unintended uses.

Steps "a" through "g" are a combination of practices currently recommended by the Air Force and the available literature (Chapter II). The remaining steps are factors which may result in a better determination of the appropriate software type and product. This is based on the information gathered through the interviews conducted.

Summary

This chapter has presented the findings and analysis based on interviews conducted among thirty individuals

spanning four organizaitons. From these interviews, significant trends in PC software selection were identified and reported. Using these trends along with the literature reviewed in Chapter II, three models were designed for the purpose of PC software requirements analysis. The normative model described the methods prescribed by regulations and publications. The descriptive model provided the actual methods users employed in determining PC software requirements. Finally the proposed model suggests a more effective and efficient means of determining software requirements and evaluating software uses. This model is based on identifying knowledge work first and then mapping the appropriate software solution to the knowldedge work. The findings and models developed in this chapter form the foundation for the following Chapter V, Conclusions and Recommendations.

V. CONCLUSIONS AND RECOMMENDATIONS

Overview

The purpose of this chapter is to present conclusions and recommendations derived from the analyses presented in Chapter IV. The information detailed in both Chapter II and Chapter IV was used to develope three PC software requirements analysis models, which were presented in the last chapter. This chapter will provide answers to research questions as well as the research objectives. In addition, the limitations of this study are addressed. Finally, recommendations for future research in the area of PC requirements analysis are presented.

Results

The objective of this study was to determine how Air Force organizations selected PC software, to examine the effectiveness of the standard practices, and to determine if a better method could be developed. Through an analysis of the information gathered, the following conclusions are suggested:

Answers to Research Questions

As a result of this analysis, the following research questions can now be answered:

1. What guidance do organizations receive when purchasing PC software? Users obtained guidance primarily from other users and from popular magazines when determining

which software to obtain. Although government regulations were available, they were seldom referenced. Additionally, although the regulations directed users to the SC staff, the users have found such sources to be non-responsive to their requests.

2. What software products are organizations currently using? Organizations were primarily using graphics packages, spreadsheets, data base managers, word processors, and integrated packages to accomplish their tasks. The majority of tasks accomplished by these software packages included authoring and scheduling, monitoring and control, and diagnosis and problem finding. In addition, organizations were using software to convert information from different applications into forms compatible with the software they were familiar with.

3. How do organizations determine which software products to obtain? As a general rule, no real requirements analysis was being conducted. The most common method was to purchase as much software as perceived necessary for future tasks at the same time as the hardware purchase (according to users, this was easier to justify to SC requirements committees) and then determine the need for the software later.

4. Are the software products being used for their intended purpose? There was no noticeable difference between the tasks intended for streamlining by the software

and the tasks actually streamlined. Thus, users were using the products for what they intended to use them for. However, in a few cases, the intended use of the product may have been inadequate, as in the cases where users attempted to accomplish organizing and scheduling tasks with a spreadsheet instead of a data base management system.

5. Could a different software product have been used to accomplish the same task at less cost? In many cases, users were employing outdated or original versions of software products to accomplish tasks. Newer versions, had they been available for government purchase, would have simplified tasks immensely (for example, some users were using DBASE II, when DBASE III+ is a much more versatile product). Users were hindered by the lack of ability to obtain software updates directly from commercial vendors. In addition, some applications could have been performed with a different software type (i.e., a spreadsheet versus a data base manager). Two factors prevented the most efficient use of the software. First, users did not have the tools to evaluate the uses of different software types available for the knowledge work tasks. Second, evaluations were limited to demonstrations of single products in most cases, with little comparisons among like applications products.

6. Which daily, mid-range and long-range operations are benefiting from the use of the software?

Authoring and presentation, monitoring and control, organizing and scheduling, and diagnosis and problem finding were streamlined through the use of software products. These products, including communications, data base management, graphics, spreadsheet, word processing, and integrated packages, were used to accommodate the knowledge work tasks. In addition, they served to provide transportability and interoperability of the information.

7. How often are individual software products used? The types of products mentioned in question 6 above were used continuously for the accomplishment of their intended tasks. Most products were used in excess of 10 hours per week per product, with hardware availability being the only hindrance to more extensive use.

8. Who (by organizational position) uses the software? There was no clear pattern of use by position. In most cases, the critical products were used by all personnel assigned to the office interviewed.

Answers to Research Objectives

In order to develop an effective PC software requirements analysis model, the following observations were necessary:

1. Determining whether or not a set of uniform PC software selection criteria at base level existed.
2. Determining how effective the existing methods of selecting PC software were.
3. Determining what additional factors that organizations should evaluate before acquiring PC software.

The following conclusions were made:

Objectives 1 and 2. Two standards for acquiring PC software exist. The normative approach prescribed by Air Force regulations outlines a process for determining requirements and acquisition of software. However, this approach is not clear in helping users select the appropriate software. The descriptive approach has differed from the regulatory approach in that users select software first and then find a need to fit the software. Data suggests, however, that at times this has resulted in less optimum use of the software.

Objective 3. A requirements analysis model was necessary to specifically provide users with a means of categorizing their requirements into knowlede work tasks, and to select software designed to satisfy the identified knowledge work. Such a model has been developed using the tasks identified by respondents and the literature available on the subjects of MIS design, user involvement, and requirements analysis techniques. This model, presented in Chapter IV, is offered as a solution to the current problem.

Scope and Limitations

The following limitations applied to this research:

Types of Systems Analyzed. Only IBM PC compatible systems were analyzed. This was done to take advantage of regulations guiding the Standard Small Computer Contract specifications, which currently directs organizations to

purchase such systems for general purpose office automation. In addition, future PC procurements will be conducted through the Standard Small Computer Contract. Consequently, data gathered in this study may aid future users in their requirements analysis.

Types of Software. Only Applications software requirements were addressed. Systems software requirements were excluded, since all computers on the Standard Small Computer Contract were delivered with a Disk Operating System (DOS).

Interviews. Interview input was limited to two areas: SCTC personnel, and organizations currently using PCs.

Sample Size. The sample size of the population interviewed was small. While accurate for the organizations under study, a greater number of organizations with varying sizes and structures need to be surveyed to substantiate the effectiveness of the proposed model over the entire Air Force.

Recommendations

This study highlights several trends in PC software selection by organizations. The proposed requirements analysis model presented in Chapter IV is recommended as a possible solution to streamlining the selection of PC software. Additionally, the questions and methods discussed in chapter III serve as a means for determining an acurate

requirements analysis strategy for PC based management information systems. Specifically, organizations may wish to use the survey in Appendix 1 as an evaluation tool for existing PC software use within current offices.

While the conclusions reached are accurate for the organizations surveyed in this study, the limitations of the sample size and number of units interviewed may not reflect the most used knowledge work tasks or the software products used to satisfy those tasks for the Air Force in general. Future researchers may wish to employ the use of the survey in Appendix 1 on a larger population sample. Addtionally, since most software requirements appeared to be driven by the hardware acquisition process, one may wish to study this area in detail. Another related area which appears fruitful for further study is the way training is obtained for software. Finally, the interface between SC personnel and PC end-users should be looked at in greater detail to determine a more effective interface.

Summary

The reseach presented here is based on the interviews of thirty people in four organizations. Consequently, the scope may be limited. However, the study achieved three important goals. First, the study established the way PC software acquisition should be procured, according to Air Force regulations. Second, the study examined the effectiveness of the prescribed methods, and also examined

the reliability of standard software acquisition practices. Finally, the study presented a proposed model to streamline the PC software requirements analysis process. This model is designed to help organizations decide which tasks should be automated and what types of software should be acquired to accomplish those tasks.

Air Force organizations must streamline operations and do more with less, if they are to continue operations despite the current budgetary climate. The existence of information systems allows mission objectives to be achieved in spite of manpower reductions and increased responsibilities. The development of a PC software requirements analysis methodology may allow more organizations to obtain the appropriate, needed software. By applying the model detailed in Chapter IV, better selection of PC software should result in increased mission effectivenes at less cost to the Air Force.

Appendix 1. Personal Computer Software Requirements Analysis Survey

AUTHOR: Capt D. Handy
DATE/TIME OF INTERVIEW:___
BUILDING #:_____
ROOM #:_____
POINT OF CONTACT:_____

PERSONAL COMPUTER SOFTWARE REQUIREMENTS
ANALYSIS SURVEY

The purpose of this interview is to examine how Air Force units at Wright Patterson Air Force Base currently determine their PC Software requirements, and the way in which they acquire their software. The information gathered in this interview will be used along with interviews from other base organizations to develop a requirements analysis model for easier determination of software that organizations may need to streamline mission operations.

BACKGROUND/DEMOGRAPHIC INFORMATION

Name of unit_____

Unit mission_____

Size of Unit_____

a. # Officers _____

b. # Enlisted _____

c. # Civilians_____

Person interviewed/rank_____

a. Job Title_____

b. Length of time in unit_____

c. Length of time in present position_____

INDIVIDUAL RESPONSES WILL BE KEPT CONFIDENTIAL AND ALL RESPONSES WILL BE REPORTED BY GROUP MEANS OR TRENDS

1. Please identify the types of software products your unit is currently using:

TYPE OF PRODUCT	NAME OF PRODUCT	COST
Word Processors		
Spreadsheets		
Data Base Management Systems		
Scheduling systems		
Graphics		
Forms publications		
Accounting		
Communications		
Data Security		
Programming Languages		
Desk Top Management		
Other (specify)		

2. Which three software packages are the most critical to your organization's operations?

#1. _____

#2. _____

#3. _____

a. Who, by rank and position, use those the most?

#1. _____

#2. _____

#3. _____

b. How did you acquire those particular software systems?

#1. _____

#2. _____

#3. _____

3. Did you find it necessary to consult other organizations or individuals before acquiring your software for your PC's (Samples are listed below)?

   a. MAJCOM/Base Small Computer Technical Center
   b. Local Communications unit
   c. Base Administrative Communications office
   d. Base Contracting Office
   e. Civilian consulting firms (please specify)
   f. Internal resources (please specify)
   g. Did not consult anyone

4. Did you find it necessary to consult any regulations or publications when you were determining your organization's requirements (samples are listed below)?

   a. AFR 700-3, Information Systems Requirements Processing

   b. AFR 700-26, Acquisition and Management of Small Computers

   c. AFR 700-30, How to Determine and Justify Information Systems Requirements in an Office Environment

   d. Other regulations/publications/policy letters (specify)_____

   e. Professional/popular journal or magazine (specify)_____

   f. Did not consult any regulations or publications

5. (FOR EACH OF THE SOFTWARE PRODUCTS MAINTAINED) How did your unit determine the need for that particular software product?

6. (FOR EACH OF THE SOFTWARE PRODUCTS USED) Which tasks did you intend to streamline with the software package?

7. (FOR EACH SOFTWARE PRODUCT USED) Which of these particular tasks were streamlined through the use of that software product?

8. (FOR EACH SOFTWARE PRODUCT USED) Which of these particular tasks were not streamlined through the use of the software product?

9. (FOR EACH SOFTWARE PRODUCT USED) In your opinion, did the software product successfully satisfy its intended use?

10. (FOR EACH SOFTWARE PRODUCT USED) What other software products did you consider for accomplishing the task?

11. (FOR EACH SOFTWARE PRODUCT USED) Why did you decide to select the chosen software product over the other choices?

12. Which daily tasks have been simplified through the use of the software products?

13. Which monthly or quarterly tasks have been simplified through the use of the software products?

14. Which annual or nonrecurring tasks have been simplified through the use of the software products?

15. (FOR EACH SOFTWARE PRODUCT USED) How often does your unit use the software product?

Appendix 2: Software Inventory

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
CO	CALL	AAAAA	JJJ	$0.00
			JJJJJ	$0.00
			JJ	$0.00
	CHI BOARD	BBBBB	DMSC	$0.00
	COORDINATOR	CCCCC	LLL	$500.00
	MS-KERMIT	CCCCC	LL	
	PC TERM	CCCCC	LLZ	
	PCXFER	CCCCC	LLL	
	PROCOMM	CCCCC	LL	
			LLLL	
		AAAAA	JJJJJ	
			JJJ	
	SMART TERM	CCCCC	LLL	$350.00
	240			
	Z COMM	CCCCC	LLL	
	Z STEM	CCCCC	LL	$33.00
			LL	$33.00
			LLL	$33.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			LLZ	$33.00
			LLL	$33.00
		AAAAA	JJJJJ	$33.00
			JJJ	$33.00
			JJJJJ	$33.00
	ZSTEM	BBBBB	EEEEE	$33.00
		CCCCC	DDD	$33.00
		AAAAA	EE	$33.00
DB	CONDOR	BBBBB	FFFF	
		CCCCC	FFF	
	CONDOR III	CCCCC	FF	
	D BASE III+	BBBBB	FFFF	$362.00
	DATAEASE	CCCCC	DDD	$0.00
	DBASE II	CCCCC	FFZ	$355.00
		AAAAA	GGGGG	$355.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			EE	$355.00
	DBASE II;DBASEIII	BBBBB	HHHME	$355.00
	DBASE III	BBBBB	HHHME	$355.00
			HHHMS	$355.00
		CCCCC	FFG	$355.00
		AAAAA	III	$355.00
			IIIII	$355.00
			EE	$355.00
	DBASE III+	BBBBB	HHHC	$355.00
			FFFFPA	$499.00
		CCCCC	LLL	$355.00
			FF	$355.00
			FFF	$355.00
			FFFA	$355.

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
	HOMEBASE	AAAAA	III	
	MICROX	BBBBB	HHHCDI	$45000.00
	PARTS MASTER	BBBBB	HHHCDI	$5000.00
			HHHCX	$5000.00
			FFFF	$5000.00
	PCFILE	AAAAA	III	
	Q&A	CCCCC	FFFA	
DM	WINDOWS	BBBBB	HHHMS	
		AAAAA	GGGGG	$0.00
			EE	$0.00
FP	PAGEMAKER	BBBBB	FFFFPA	$595.00
GR	CAD-3D	AAAAA	GGGGG	
	CHART	BBBBB	HHHC	$0.00
			HHHCR2	$0.00
			HHHMS	
			FFFF	$0.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			FFFFPA	$0.00
		AAAAA	GGGGG	$0.00
			III	$0.00
			IIIII	$0.00
			EE	$0.00
	GRAFTALK	BBBBB	HHHC	$0.00
		CCCCC	FF	$0.00
	HARVARD GRAPHICS	CCCCC	LL	$362.00
			FF	$362.00
			FFG	$362.00
			FFF	$362.00
			FFFA	$362.00
			FFZ	$362.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			FFF	$362.00
			DDD	$362.00
		AAAAA	III	$362.00
			EE	$362.00
	SHOWMAKER	CCCCC	FFZ	
	STATGRAPHICS	CCCCC	FF	
IT	ABILITY	CCCCC	FFFA	$79.00
	ENABLE	BBBBB	HHHC	$87.00
			HHHME	$87.00
		CCCCC	FF	$87.00
			FFG	$87.00
			FFF	
			FFFA	$87.00
			FFZ	$87.00
			FFF	$87.00
			DDD	$87.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
		AAAAA	GGGGG	$87.00
			III	$87.00
			IIIII	$87.00
			EE	$87.00
OT	EXCELLERATOR	CCCCC	DDD	
	MICROSTAT	CCCCC	DDD	$0.00
	PATHMASTER	CCCCC	DDD	$0.00
	QBS	CCCCC	DDD	$0.00
	RESNET LAN	AAAAA	EE	$0.00
	PRINT CONT			
	SIMPLE-1	CCCCC	FF	
	TOOLS	BBBBB	HHHMS	
PL	ASSEMBLER	CCCCC	DDD	
	BASIC	BBBBB	HHHME	$12.00
		CCCCC	FF	$12.00
			FFG	$12.00
			FFZ	$12.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			DDD	$12.00
		AAAAA	GGGGG	$12.00
			III	$12.00
			IIIII	$12.00
	C	CCCCC	DDD	
	C-86	CCCCC	FF	
	C86	CCCCC	DDD	$0.00
	COBOL	BBBBB	HHHC	$15.00
		AAAAA	EE	$15.00
	FORTRAN	CCCCC	FF	$16.00
			FFZ	$16.00
			DDD	$16.00
		AAAAA	GGGGG	$16.00
			EE	$16.00
	GW BASIC	BBBBB	HHHC	$12.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
		AAAAA	EE	$12.00
	MS FORTRAN	BBBBB	HHHC	$16.00
	PASCAL	BBBBB	HHHC	$12.00
		CCCCC	FF	$12.00
			FFZ	$12.00
			DDD	$12.00
		AAAAA	GGGGG	$12.00
			EE	$12.00
	TURBO PASCAL	CCCCC	LLL	$40.00
	TURBOPASCAL	CCCCC	FFF	$40.00
			FFZ	$40.00
			FFF	
	Z-BASIC	CCCCC	DDD	$12.00
PM	CAPPS	CCCCC	DDD	
	EXPERT SYSTEM	CCCCC	DDD	

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
	HARVARD TOTAL PROJECT MGR	CCCCC	DDD	
	SUPERPROJECT EXPERT	CCCCC	DDD	
	TIMELINE	BBBBB	HHHC	$53.00
		CCCCC	FF	
			FFFA	
			DDD	
				$53.00
		AAAAA	III	
			EE	$33.00
SS	LOTUS 123	BBBBB	HHHCR2	$362.00
			FFFF	$362.00
		CCCCC	LLL	$362.00
			FF	$362.00
			FFF	$362.00
			FFFA	$362.00
			FFZ	$362.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			DDD	$362.00
		AAAAA	GGGGG	$362.00
			III	$362.00
			IIIII	$362.00
			EE	$362.00
	PEACHCALC	AAAAA	EE	$87.00
	PERFECT CALC	CCCCC	FFF	
	QUATRO	CCCCC	FF	
			FFG	$40.00
			FFF	
	SUPERCALC 2	BBBBB	FFFFPA	$350.00
	SUPERCALC 3	BBBBB	FFFF	$350.00
		CCCCC	FFFA	
	SUPERCALC III	CCCCC	FF	
	VP PLANNER	CCCCC	FF	

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			FFG	$40.00
			FFF	$20.00
			FFZ	$20.00
	VP PLUS	CCCCC	LLL	$100.00
ST	BASS	CCCCC	LLL	$40.00
	BASSBASE	CCCCC	FF	
	BASSVIEW	CCCCC	FF	
	MATHCAD	CCCCC	LLL	$200.00
			FFZ	
	MICROSTAT	CCCCC	FF	$362.00
			FFZ	
			DDD	
	POWERPACK	CCCCC	LLL	$20.00
WP	MS WORD	CCCCC	LLL	$400.00
	MULTIMATE	CCCCC	FF	
		AAAAA	III	

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
	PCWRITE	AAAAA	III	
	PEACHTEXT	CCCCC	FF	$0.00
			DDD	$0.00
		AAAAA	GGGGG	$0.00
			III	$0.00
			EE	$0.00
	VOLKS WRITER	CCCCC	FFZ	
	VOLKSWRITER-3	CCCCC	FF	
	WORDPERFECT	CCCCC	DDD	$0.00
	WORDSTAR	BBBBB	HHHC	$130.00
			HHHCR2	$130.00
			HHHME	$130.00
			HHHMS	$130.00
		CCCCC	LL	$130.00
			FF	$130.00
			FFFA	$130.00

SW TYPE	PRODUCT NAME	UNIT	OFFICE	UNIT COST
			FFZ	$130.00
			FFF	$130.00
			DDD	$130.00
		AAAAA	GGGGG	$130.00
			III	$130.00
	WRITE ONE	CCCCC	LLL	$400.00
			FF	
	WRITESOFT	BBBBB	FFFFPA	

Appendix 3: Critical Software Products

SW TYPE	UNIT	OFFICE	CRIT PROD#	PRODUCT NAME	UNIT COST
CO	CCCCC	LL	1	MS-KERMIT	
				PROCOMM	
				Z STEM	$33.00
		LLL	1	SMART TERM 240	$350.00
			2	COORDINATOR	$500.00
		DDD	3	ZSTEM	$33.00
	AAAAA	III	3	Z STEM	$33.00
DB	BBBBB	HHHCDI	1	MICROX	$45000.00
			2	PARTS MASTER	$5000.00
		HHHCX	1	PARTS MASTER	$5000.00
		HHHME	1	DBASE II;DBASEIII	$355.00
				DBASE III	$355.00
		HHHMS	2	DBASE III	$355.00
		FFFF	1	CONDOR	
			2	D BASE III+	$362.00
			3	PARTS MASTER	$5000.00
		FFFFPA	2	DBASE III+	$499.00
	CCCCC	FFG	2	DBASE III	$355.00
		FFF	3	DBASE III+	$355.00
		FFF	4	CONDOR	
	AAAAA	IIIII	3	DBASE III	$355.00
GR	BBBBB	HHHCR2	3	CHART	$0.00

SW TYPE	UNIT	OFFICE	CRIT PROD#	PRODUCT NAME	UNIT COST
GR	BBBBB	FFFF	2	CHART	$0.00
		FFFFPA	1	CHART	$0.00
	CCCCC	LL	3	HARVARD GRAPHICS	$362.00
		FF	2	HARVARD GRAPHICS	$362.00
		FFF	1	HARVARD GRAPHICS	$362.00
		FFFA	3	HARVARD GRAPHICS	$362.00
		FFZ	2	HARVARD GRAPHICS	$362.00
			3	HARVARD GRAPHICS	$362.00
		FFF	3	HARVARD GRAPHICS	$362.00
		DDD	1	HARVARD GRAPHICS	$362.00
					$362.00
					$362.00
			2	HARVARD GRAPHICS	$362.00
	AAAAA	GGGGG	1	CHART	$0.00
		EE	[illegible]	CHART	$0.00
IT	CCCCC	FFFA	1	ABILITY	$79.00
		FFF	2	ENABLE	$87.00
		DDD	2	ENABLE	$87.00
					$87.00
			3	ENABLE	$87.00
	AAAAA	III	1	ENABLE	$87.00

SW TYPE	UNIT	OFFICE	CRIT PROD#	PRODUCT NAME	UNIT COST
		IIIII	2	ENABLE	$87.00
		EE	1	ENABLE	$87.00
					$87.00
OT	CCCCC	DDD	2	QBS	$0.00
PL	AAAAA	GGGGG	3	BASIC	$12.00
PM	CCCCC	DDD	3	EXPERT SYSTEM	
				TIMELINE	
SS	BBBBB	HHHCR2	1	LOTUS 123	$362.00
		FFFF	1	LOTUS 123	$362.00
			3	SUPERCALC 3	$350.00
	CCCCC	FF	3	LOTUS 123	$362.00
				QUATRO	
				SUPERCALC III	
				VP PLANNER	
		FFG	1	VP PLANNER	$40.00
		FFF	2	LOTUS 123	$362.00
				QUATRO	
				VP PLANNER	$20.00
		FFZ	1	LOTUS 123	$362.00
				VP PLANNER	$20.00
			2	LOTUS 123	$362.00
		FFF	1	PERFECT CALC	
	AAAAA	GGGGG	2	LOTUS 123	$362.00

SW TYPE	UNIT	OFFICE	CRIT PROD#	PRODUCT NAME	UNIT COST
		III	2	LOTUS 123	$362.00
		IIIII	1	LOTUS 123	$362.00
		EE	2	LOTUS 123	$362.00
			3	LOTUS 123	$362.00
ST	CCCCC	LLL	3	BASS	$40.00
				MATHCAD	$200.00
				POWERPACK	$20.00
		FFZ	1	MICROSTAT	
			3	MICROSTAT	
WP	BBBBB	HHHCR2	2	WORDSTAR	$130.00
		HHHME	2	WORDSTAR	$130.00
		HHHMS	1	WORDSTAR	$130.00
		FFFFPA	3	WRITESOFT	
	CCCCC	LL	2	WORDSTAR	$130.00
		FF	1	MULTIMATE	
				PEACHTEXT	$0.00
				VOLKSWRITER-3	
				WORDSTAR	$130.00
				WRITE ONE	
		FFFA	2	WORDSTAR	$130.00
		FFF	1	WORDSTAR	$130.00
		DDD	1	WORDPERFECT	$0.00
	AAAAA	EE	1	PEACHTEXT	$0.00

SW TYPE	UNIT	OFFICE	CRIT PROD#	PRODUCT NAME	UNIT COST
			3	PEACHTEXT	$0.00

Appendix 4: Primary Users of Software Products

SW TYPE	PRODUCT NAME	UNIT	CRIT PROD#	PRIMARY TYPE OF USERS
CO	COORDINATOR	CCCCC	2	N/A
	MS-KERMIT	CCCCC	1	EVERYONE
	PROCOMM	CCCCC	1	EVERYONE
	SMART TERM 240	CCCCC	1	N/A
	Z STEM	CCCCC	1	EVERYONE
		AAAAA	3	ALL PERSONNEL
	ZSTEM	CCCCC	3	FACULTY
DB	CONDOR	BBBBB	1	GS-11, CHIEF
		CCCCC	4	DR XXXXX - FOR ARCHIVAL ONLY
	D BASE III+	BBBBB	2	SSGT-NCOIC
	DBASE II	BBBBB	1	SUPPLY CLERKS
	DBASE III	BBBBB	1	SUPPLY CLERKS TSGT;GS-7
			2	REQUISITIONING TECHNICIANS
		CCCCC	2	1;LTCOL XXXXXXXX
		AAAAA	3	1 CIVILIAN GS-12
	DBASE III+	BBBBB	2	GS-9 COST ANALYST
		CCCCC	3	6 INSTRUCTORS USE FOR ADMIN DUTIES
	MICROX	BBBBB	1	GS-2
	PARTS MASTER	BBBBB	1	A1C/ASST NCOIC
			2	GS-2

SW TYPE	PRODUCT NAME	UNIT	CRIT PROD#	PRIMARY TYPE OF USERS
			3	SSGT, NCOIC TRNG
GR	CHART	BBBBB	1	GS-11 COST ANALYST
			2	MANAGER AND TECHNICIANS
		AAAAA	1	EVERYONE (8)
			2	PROJECT MANAGERS
	HARVARD GRAPHICS	CCCCC	1	30 PEOPLE - INSTRUCTORS SPECIFIED BY VICE COMMANDANT TOTAL DEPT ALL PROFESSORS FACULTY;STAFF
			2	FACULTY SECRETARIES FACULTY FACULTY
			3	FACULTY PROFESSORS 12 FACULTY EVERYONE ALL MEMBERS
IT	ABILITY	CCCCC	1	4 FACULTY
	ENABLE	CCCCC	2	FACULTY THESIS REVIEWERS FACULTY
			3	PRIVATELY OWNED COPY
		AAAAA	1	CLERICAL;MANAGER ALL PERSONNEL FINANCIAL MANAGERS

SW TYPE	PRODUCT NAME	UNIT	CRIT PROD#	PRIMARY TYPE OF USERS
			2	EVERYONE
OT	QBS	CCCCC	2	FACULTY MEMBER
PL	BASIC	AAAAA	3	2 ENGINEERS
PM	EXPERT SYSTEM	CCCCC	3	FACULTY MEMBER
	TIMELINE	CCCCC	3	CAPT XXXXXX
SS	LOTUS 123	BBBBB	1	MANAGER AND TECHNICIANS NCOIC, REPAIR CYCLE SUB-UNIT
		CCCCC	1	FACULTY
			2	FACULTY PROFESSORS ASSOCIATE DEAN INSTRUCTORS; LTCOL XXXXXXXXX DEPT HEAD
			3	FACULTY
		AAAAA	1	EVERYONE
			2	3 ENGINEERS ALL MANAGERS WORKERS (COST ANALYSTS) PROFESSIONALS
			3	CLERICAL PERSONNEL
	QUATRO	CCCCC	2	ASSOCIATE DEAN INSTRUCTORS; LTCOL XXXXXX DEPT HEAD
			3	FACULTY
	SUPERCALC 3	BBBBB	3	MANAGER/TECHNICIANS

SW TYPE	PRODUCT NAME	UNIT	CRIT PROD#	PRIMARY TYPE OF USERS
	SUPERCALC III	CCCCC	3	FACULTY
	VP PLANNER	CCCCC	1	FACULTY 1;DIRECTOR OF STUDENT OPERATIONS
			2	ASSOCIATE DEAN INSTRUCTORS; LTCOL XXXXXXXXX DEPT HEAD
			3	FACULTY
ST	BASS	CCCCC	3	N/A
	MATHCAD	CCCCC	3	N/A
	MICROSTAT	CCCCC	1	FACULTY PROFESSORS
			3	FACULTY
	POWERPACK	CCCCC	3	N/A
WP	MULTIMATE	CCCCC	1	SECRETARIES; FACULTY
	PEACHTEXT	CCCCC	1	SECRETARIES; FACULTY
		AAAAA	1	FINANCIAL MANAGERS;
			3	CLERICAL WORKERS
	VOLKSWRITER-3	CCCCC	1	SECRETARIES; FACULTY
	WORDPERFECT	CCCCC	1	PRIVATELY OWNED PRODUCT
	WORDSTAR	BBBBB	1	PURCHASE CLERKS;

SW TYPE	PRODUCT NAME	UNIT	CRIT PROD#	PRIMARY TYPE OF USERS
			2	TSGT;GS-7
		CCCCC	1	SECRETARIES; FACULTY 2 PEOPLE
			2	EVERYONE 1 FACULTY
	WRITE ONE	CCCCC	1	SECRETARIES; FACULTY
	WRITESOFT	BBBBB	3	GS-9, COST ANALYST

Appendix 5: How Critical Software Products Were Acquired

SW TYPE	PRODUCT NAME	UNIT	HOW ACQUIRED
CO	COORDINATOR	CCCCC	PURCHASE THROUGH CCCCC
	MS-KERMIT	CCCCC	SEAT OF THE PANTS;INTUITION
	PROCOMM	CCCCC	SEAT OF THE PANTS;INTUITION
	SMART TERM 240	CCCCC	SELF PURCHASE
	Z STEM	CCCCC	SEAT OF THE PANTS;INTUITION
		AAAAA	CAME WITH SYSTEM
	ZSTEM	CCCCC	STANDARD ZENITH CONTRACT
DB	CONDOR	BBBBB	STANDARD ZENITH CONTRACT (WITH PURCHASE OF Z100)
	D BASE III+	BBBBB	PURCHASE
	DBASE II;DBASEIII	BBBBB	STANDARD ZENITH CONTRACT
	DBASE III	BBBBB	STANDARD ZENITH CONTRACT STANDARD ZENITH CONTRACT STANDARD ZENITH CONTRACT
		CCCCC	ACQUIRED AS EVALUATION COPY FROM COMPANY
		AAAAA	ASD CONTRACT
	DBASE III+	BBBBB	LOCAL PURCHASE (AF)
		CCCCC	SINGLE COPY

SW TYPE	PRODUCT NAME	UNIT	HOW ACQUIRED
			PURCHASED FOR FACULTY EVALUATION
	MICROX	BBBBB	
	PARTS MASTER	BBBBB	ORDERED BY BASE
GR	CHART	BBBBB	STANDARD CONTRACT SUPPLY USAF PUBLIC DOMAIN SOFTWARE
		AAAAA	STANDARD ZENITH CONTRACT PUBLIC DOMAIN
	HARVARD GRAPHICS	CCCCC	CAME WITH SYSTEM ACQUISITION;HIGHER DECISION LEVEL FORM 9 PURCHASE CSRD PURCHASED SOLE SOURCE DON'T KNOW CCCCC/SC CHANNELS ZENITH CONTRACT CONSULTED FF;MR XXXXXXX + LTCOL XXXXXXX + XXXXXXXXXX GSA CONTRACT PRIVATE USE;PRODUCT DEMONSTRATION GOVT PURCHASE
IT	ABILITY	CCCCC	FORM 9 PURCHASE
	ENABLE	CCCCC	ZENITH CONTRACT STANDARD ZENITH CONTRACT CAME WITH SYSTEM ACQUISITION VENDOR COURTESY COPY
		AAAAA	STANDARD ZENTIH CONTRACT CAME WITH SYSTEM

SW TYPE	PRODUCT NAME	UNIT	HOW ACQUIRED
			ASD CONTRACT ASD CONTRACT
OT	QBS	CCCCC	PUBLIC DOMAIN (LTCOL XXXXXXX)
PL	BASIC	AAAAA	GOVT PURCHASE
PM	EXPERT SYSTEM	CCCCC	INFORMAL CONTACTS;PROFESS. RELAT.;VENDOR DEMOS;EVAL COPY;STUDENTS
	TIMELINE	CCCCC	ZENITH CONTRACT
SS	LOTUS 123	BBBBB	PURCHASED THROUGH BASE STANDARD CONTRACT
		CCCCC	MAINFRAME BURROUGHS SUPPLY CHANNELS AND EDUCATIONAL SOURCES (WITH GREAT DIFFICULTY) CLASSROOM REQUIREMENTS LOCAL PURCHASE (PRIVATELY OWNED)
		AAAAA	ASD CONTRACT GOVT PURCHASE DO NOT KNOW ASD CONTRACT ASD ISTC SMALL COMPUTER CONTRACT
	PERFECT CALC	CCCCC	
	QUATRO	CCCCC	MAINFRAME BURROUGHS CLASSROOM REQUIREMENTS
	SUPERCALC 3	BBBBB	
	SUPERCALC III	CCCCC	MAINFRAME BURROUGHS

SW TYPE	PRODUCT NAME	UNIT	HOW ACQUIRED
	VP PLANNER	CCCCC	MAINFRAME BURROUGHS SUPPLY CHANNELS AND EDUCATIONAL SOURCES (WITH GREAT DIFFICULTY) CLASSROOM REQUIREMENTS ACQUIRED AS EVALUATION COPY FROM COMPANY
ST	BASS	CCCCC	PURCHASE THROUGH CCCCC
	MATHCAD	CCCCC	PURCHASE THROUGH CCCCC
	MICROSTAT	CCCCC	GSA ZENITH CONTRACT FORM 9 (WITH GREAT DIFFICULTY)
	POWERPACK	CCCCC	PURCHASE THROUGH CCCCC
WP	MULTIMATE	CCCCC	MAINFRAME BURROUGHS
	PEACHTEXT	CCCCC	MAINFRAME BURROUGHS
		AAAAA	STANDARD ZENITH CONTRACT ASD CONTRACT
	VOLKSWRITER-3	CCCCC	MAINFRAME BURROUGHS
	WORDPERFECT	CCCCC	PERSONAL PURCHASE
	WORDSTAR	BBBBB	STANDARD ZENITH CONTRACT STANDARD ZENITH CONTRACT
		CCCCC	MAINFRAME BURROUGHS CAME WITH SYSTEM ACQUISITION SEAT OF THE PANTS;INTUITION

SW TYPE	PRODUCT NAME	UNIT	HOW ACQUIRED
			SMALL COMPUTER CONTRACT
	WRITE ONE	CCCCC	MAINFRAME BURROUGHS
	WRITESOFT	BBBBB	LOCAL PURCHASE (AF)

Appendix 6: How Software Needs Were Determined

SW TYPE	PRODUCT NAME	UNIT	HOW NEED WAS DETERMINED
CO	COORDINATOR	CCCCC	STUDENT REQUIREMENT ASSESSMENT
	MS-KERMIT	CCCCC	TRANSPORTABILITY; INTEROPERABILITY; COMMUNICATION
	PROCOMM	CCCCC	COMMUNICATION; INTEROPERABILITY
	SMART TERM 240	CCCCC	GRAPHICS
	Z STEM	CCCCC	COMMUNICATION; INTEROPERABILITY
		AAAAA	COMMUNICATION
	ZSTEM	CCCCC	CAME WITH SYSTEM;STANDARD ZENITH CONTRACT
DB	CONDOR	BBBBB	TRIAL AND ERROR AFTER REVIEWING OTHER PACKAGES
		CCCCC	INTEROPERABILITY; TRANSPORTABILITY
	D BASE III+	BBBBB	TRIAL AND ERROR AFTER REVIEWING OTHER PACKAGES
	DBASE II;DBASEIII	BBBBB	INTEROPERABILITY; TRANSPORTABILITY; MONITORING/CONTROL
	DBASE III	BBBBB	MONITORING/CONTROL; ORGANIZING/SCHEDULING NEEDED A DATABASE MGMT SYS AND AFLC ISTC RECOMMEND PKG INTEROPERABILITY

SW TYPE	PRODUCT NAME	UNIT	HOW NEED WAS DETERMINED
		CCCCC	TASKS PRESENTLY USING SS APPLICATION (VP PLANNER)
		AAAAA	DIAGNOSIS/PROBLEM FINDING
	DBASE III+	BBBBB	REQUIRED;MONITORING/ CONTROL
		CCCCC	LOW PRICE AT TIME OF HARDWARE PURCHASE VS HI $ LATER
	MICROX	BBBBB	ORGANIZING/SCHEDULING MONITORING/CONTROL
	PARTS MASTER	BBBBB	DIAGNOSIS/PROBLEM FINDING;ORGANIZING/ SCHEDULING;MONITORING/ CONTROL
GR	CHART	BBBBB	
			ANALYSIS HAD IT AND WE FOUND IT SATISFACTORY FREE PRODUCT; APPLICATION REQUIRED
		AAAAA	BRIEFINGS;AUTHORING/ PRESENTATION
	HARVARD GRAPHICS	CCCCC	AUTHORING/PRESENTATION
			AUTHORING/PRESENTATION OBTAINED DEMOS;REVIEWED PRODUCTS/SPECS DEFINED NEED FOR GRAPHICS PACKAGE;EVALUATED OTHERS FIRST LOW PRICE AT TIME OF HARDWARE PURCHASE VS HI $ LATER AUTHORING/PRESENTATION AUTHORING/PRESENTATION AUTHORING/PRESENTATION

SW TYPE	PRODUCT NAME	UNIT	HOW NEED WAS DETERMINED
			AUTHORING/PRESENTATION DEMONSTRATION;EVALUATION AUTHORING/PRESENTATION
IT	ABILITY	CCCCC	STUDENT INSTRUCTION AIDE
	ENABLE	CCCCC	OBTAINED
			DEMOS;REVIEWED PRODUCTS/SPECS CAME WITH SYSTEM;STANDARD ZENITH CONTRACT FIXED FIELD DB>80 COLUMNS;THESIS ADMIN;BOOLEAN SEARCH/STORAGE
		AAAAA	COST; STANDARD ZENITH CONTRACT ITEM NO DETERMINATION;PRODUCT REVIEWS IN PC MAGAZINE MANDATED BY ASD TRANSPORTABILITY; INTEROPERABILITY; COMMUNICATION;AUTHORING PRESENTATION
OT	QBS	CCCCC	DIAGNOSIS/PROBLEM FINDING;PLANNING/ DECISION MAKING
PL	BASIC	AAAAA	TRANSPORTABILITY; INTEROPERABILITY
PM	EXPERT SYSTEM	CCCCC	
	TIMELINE	CCCCC	OBTAINED DEMOS;REVIEWED PRODUCTS/SPECS

SW TYPE	PRODUCT NAME	UNIT	HOW NEED WAS DETERMINED
SS	LOTUS 123	BBBBB	HQ AFLC DIRECTED
		CCCCC	CAME WITH SYSTEM (BUNDLED) AUTHORING/PRESENTATION
			LOW PRICE AT TIME OF HARDWARE PURCHASE VS HI $ LATER AUTHORING/PRESENTATION DIAGNOSIS/PROBLEM FINDING;PLANNING/ DECISION MAKING
		AAAAA	CONSULTING USERS AND OTHER ORGANIZATIONS TIMELINE ANALYSIS OF SYSTEM;SIMULATION FACT FINDING DURING EVALUATIONS DIAGNOSIS/PROBLEM FINDING;SYSTEM DEVELOPMENT FRUSTRATED WITH DBMS/ENABLE;LIT REVIEW;TRANSPORTABILITY TRANSPORTABILITY; INTEROPERABILITY; DIAGNOSIS/PROBLEM FINDING
	PERFECT CALC	CCCCC	
	QUATRO	CCCCC	CAME WITH SYSTEM (BUNDLED) LOW PRICE AT TIME OF HARDWARE PURCHASE VS HI $ LATER
	SUPERCALC 3	BBBBB	ANALYSIS ORDERED IT TO INCREASE SPREADSHEET CAPABILITY
	SUPERCALC III	CCCCC	CAME WITH SYSTEM (BUNDLED)

SW TYPE	PRODUCT NAME	UNIT	HOW NEED WAS DETERMINED
	VP PLANNER	CCCCC	CAME WITH SYSTEM (BUNDLED) AUTHORING/PRESENTATION LOW PRICE AT TIME OF HARDWARE PURCHASE VS HI $ LATER MANAGEMENT/CONTROL; AUTHORING/PRESENTATION
ST	BASS	CCCCC	STUDENT REQUIREMENT ASSESSMENT
	MATHCAD	CCCCC	
	MICROSTAT	CCCCC	AUTHORING/PRESENTATION DIAGNOSING/PROBLEM FINDING AUTHORING/PRESENTATION DIAGNOSIS/PROBLEM FINDING
	POWERPACK	CCCCC	STUDENT REQUIREMENT ASSESSMENT
WP	MULTIMATE	CCCCC	
	PEACHTEXT	CCCCC	
		AAAAA	STANDARD CONTRACT
	VOLKSWRITER-3	CCCCC	

SW TYPE	PRODUCT NAME	UNIT	HOW NEED WAS DETERMINED
	WORDPERFECT	CCCCC	INTEROPERABILITY TRANSPORTABILITY; AUTHORING/PRESENTATION
	WORDSTAR	BBBBB	MONITORING/CONTROL AUTHORING/PRESENTATION
		CCCCC	ADMIN CORRESPONDENCE AUTHORING/PRESENTATION INTEROPERABILITY AUTHORING/PRESENTATION
	WRITE ONE	CCCCC	CAME WITH SYSTEM (BUNDLED)
	WRITESOFT	BBBBB	PERSONAL PREFERENCE;APPLICATION REQUIRED

Appendix 7: Task Analysis

SW TYPE	INTENDED TASKS	TASKS STREAMLINED	TASKS NOT STREAMLINED
CO	COMMUNICATION	COMMUNICATION; TRANSPORTABILITY	EFFECTIVE USE OF HW (PRINTERS)
	COMMUNICATION	COMMUNICATION	
	COMMUNICATION INTEROPERABILITY	ALL	NONE
	COMMUNICATION TRANSPORTABILITY INTEROPERABILITY	ALL COMMUNICATION	
	COMMUNICATIONS; INTEROPERABILITY	ALL	NONE
DB	ORGANIZING/ SCHEDULING; MONITORING/CONTROL	ALL	NONE
	MONITORING/ CONTROL	MONITORING/ CONTROL	
	ORGANIZING/ SCHEDULING	ORGANIZING/ SCHEDULING;	
	MONITORING/ CONTROL	MONITORING/ CONTROL	
	ORGANIZING/ SCHEDULING	ORGANIZING/ SCHEDULING	NONE.
	MONITORING	MONITORING	
	CONTROL	CONTROL	
	DIAGNOSIS/ PROBLEM FINDING	DIAGNOSIS/ PROBLEM FINDING	NONE.
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	MONITORING CONTROL	ALL	
	MONITORING/ CONTROL	ALL PLUS T/A LOG	
	MONITORING CONTROL	MONITORING/ CONTROL	
	ORGANIZING/ SCHEDULING	ORGANIZING/ SCHEDULING;MONITORING CONTROL;DIAGNOSIS PROBLEM FINDING	

SW TYPE	INTENDED TASKS	TASKS STREAMLINED	TASKS NOT STREAMLINED
		MONITORING/ CONTROL	ENDLESS LIST;POST TO POST TRANSACTIONS STILL UNDER DEVELOPMENT
	MONITORING/CONTROL		
	ORGANIZING/ SCHEDULING AUTHORING/ PRESENTATION; MONITORING/CONTROL	ALL	NONE
	DIAGNOSIS/ PROBLEM FINDING MONITORING/ CONTROL	ALL	
		DIAGNOSIS/ PROBLEM FINDING	
GR	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	AUTHORING/ PRESENTATION	ALL, BUT TAKES MORE INDIVIDUAL TIME;COMPOSING TIME + MANUAL TASKS;ELEMENT OF EFFICIENCY AND EFFECTIVENESS; AUTHORING; PRESENTATION	ALL TASKS TAKE MORE PERSONNEL TIME DUE TO COMPOSITION BUT THAT IS NOT NECESSARILY BAD
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	NONE
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	BRIEFING; AUTHORING/ PRESENTATION	ALL	
	AUTHORING/ PRESENTATION	ALL	NONE
	AUTHORING/ PRESENTATION	ALL	NONE
	AUTHORING/ PRESENTATION	ALL	
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	NONE

SW TYPE	INTENDED TASKS	TASKS STREAMLINED	TASKS NOT STREAMLINED
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	NONE
	AUTHORING/ PRESENTATION	ALL	
	AUTHORING/ PRESENTATION	ALL	
	AUTHORING/ PRESENTATION	ALL	NONE. AUTHORING/
	AUTHORING/ PRESENTATION; INTEROPERABILITY TRANSPORTABILITY	PRESENTATION; INTEROPERABILITY TRANSPORTABILITY	
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	AUTHORING/ PRESENTATION; DIAGNOSIS/PROBLEM FINDING	AUTHORING/ PRESENTATION	N/A
IT	MONITORING/ CONTROL INTEROPERABILITY TRANSPORTABILITY	MONITORING/ CONTROL	AUTHORING/ PRESENTATION INTEGRATION OF SS AND WP TASKS;MAY BE DUE TO HW INCOMPATIBILITY AND A LACK OF TRAINING; INTEROPERABILITY
	MONITORING/CONTROL ORGANIZING/ SCHEDULING; AUTHORING/ PRESENTATION		
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	DIAGNOSIS/ PROBLEM FINDING AUTHORING PRESENTATION	ALL	
	AUTHORING/ PRESENTATION	ALL	
	AUTHORING/ PRESENTATION; INTEROPERABILITY TRANSPORTABILITY	ALL	

SW TYPE	INTENDED TASKS	TASKS STREAMLINED	TASKS NOT STREAMLINED
	AUTHORING/ PRESENTATION; INTEROPERABILITY	AUTHORING/ PRESENTATION; INTEROPERABILITY DIAGNOSIS/PROBLEM FINDING; TRANSPORTABILITY	GOVT VERSION INADEQUATE; PERSONAL VERSION SATISFIES TASKS;PERSONAL VERSION UPGRADED AND PRIVATELY PURCHASED
OT	PLANNING/ DECISION MAKING;DIAGNOSIS PROBLEM FINDING	ALL, BUT TAKES MORE INDIVIDUAL TIME;COMPOSING TIME + MANUAL TASKS;ELEMENT OF EFFICIENCY AND EFFECTIVENESS	ALL TASKS TAKE MORE PERSONNEL TIME DUE TO COMPOSITION BUT THAT IS NOT NECESSARILY BAD
PL	NONE		NONE
PM	MONITORING/ CONTROL;SYSTEM DEVELOPMENT	MONITORING/ CONTROL;SYSTEM DEVELOPMENT	NONE
		ALL	ALL TASKS TAKE MORE PERSONNEL TIME DUE TO COMPOSITION BUT THAT IS NOT NECESSARILY BAD
SS	PLANNING/ DECISION MAKING; MONITORING/ CONTROL	TRANSPORTABILITY INTEROPERABILITY PLANNING/DECISION MAKING MONITORING CONTROL	
	AUTHORING/ PRESENTATION		MINIMAL SUCCESS
	INTEROPERABILITY	INTEROPERABILITY	NONE
	MONITORING/ CONTROL;	MONITORING/ CONTROL;ORGANIZING SCHEDULING;	

SW TYPE	INTENDED TASKS	TASKS STREAMLINED	TASKS NOT STREAMLINED
		TRANSPORTABILITY	
	PLANNING/ DECISION MAKING;DIAGNOSIS PROBLEM FINDING	ALL	
	DIAGNOSIS/ PROBLEM FINDING	ALL	
	NONE;SAW APPLICATIONS AFTER SW ACQUIRED	DIAGNOSIS/ PROBLEM FINDING;SYSTEM DEVELOPMENT	NONE
	AUTHORING/ PRESENTATION		MINIMAL SUCCESS
	AUTHORING/ PRESENTATION		MINIMAL SUCCESS
	AUTHORING/ PRESENTATION		MINIMAL SUCCESS
		PLANNING/DECISION MAKING	
	DIAGNOSIS/ PROBLEM FINDING;MONITORING CONTROL	ALL	NONE.
	MONITORING/ CONTROL	MONITORING/ CONTROL	N/A
	AUTHORING/ PRESENTATION MONITORING/CONTROL	ALL	NONE
	AUTHORING/ PRESENTATION DIAGNOSIS/PROBLEM FINDING;PLANNING DECISION MAKING	ALL	NONE
	AUTHORING/ PRESENTATION MONITORING/CONTROL	ALL	NONE
	AUTHORING/ PRESENTATION MONITORING/CONTROL	ALL	NONE.
	MONITORING/ CONTROL	MONITORING/ CONTROL	NONE
	DIAGNOSIS/ PROBLEM FINDING	ALL	

SW TYPE	INTENDED TASKS	TASKS STREAMLINED	TASKS NOT STREAMLINED
	AUTHORING/ PRESENTATION MONITORING/CONTROL	ALL	NONE
ST	DIAGNOSIS/ PROBLEM FINDING	ALL	NONE
	AUTHORING/ PRESENTATION	ALL	NONE
		AUTHORING/ PRESENTATION	ALL NONE
	DIAGNOSING/ PROBLEM FINDING	ALL	NONE
WP	AUTHORING/ PRESENTATION	ALL	
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION; TRANSPORTABILITY	GOVT VERSION INADEQUATE; PERSONAL VERSIONS SATISFY TASKS;PERSONAL VERSIONS ARE UPGRADED VERSIONS AND PRIVATELY PURCHASED; INTEROPERABILITY
	AUTHORING/ PRESENTATION MONITORING/ CONTROL	AUTHORING/ PRESENTATION MONITORING/ CONTROL	N/A
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	AUTHORING/ PRESENTATION	FUTURE TASKS	ADMIN CORRESPONDENCE AUTHORING/ PRESENTATION
	AUTHORING/ PRESENTATION	ALL	
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	

SW TYPE	INTENDED TASKS	TASKS STREAMLINED	TASKS NOT STREAMLINED
	AUTHORING/ PRESENTATION INTEROPERABILITY	AUTHORING/ PRESENTATION ALL	
	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	
	AUTHORING/ PRESENTATION MONITORING CONTROL	AUTHORING/ PRESENTATION	DESKTOP PUBLISHING
	AUTHORING/ PRESENTATION	ALL	

Appendix 8: User Satisfaction with Software Products

SW TYPE	UNIT	PRODUCT NAME	SATISFACTION
CO	CCCCC	COORDINATOR	Y
		MS-KERMIT	N
		PROCOMM	N
		SMART TERM 240	Y
		Z STEM	N
		ZSTEM	
	AAAAA	Z STEM	Y
DB	BBBBB	CONDOR	Y
		D BASE III+	Y
		DBASE II	Y
		DBASE III	Y Y Y
		DBASE III+	Y
		MICROX	Y
		PARTS MASTER	Y Y Y
	CCCCC	CONDOR	
		DBASE III	
		DBASE III+	Y
	AAAAA	DBASE III	Y
GR	BBBBB	CHART	Y Y Y
	CCCCC	HARVARD	Y

SW TYPE	UNIT	PRODUCT NAME	SATISFACTION
		GRAPHICS	
			Y
			Y
			Y
			Y
			Y
			Y
			Y
			N
			Y
			Y
	AAAAA	CHART	Y
			Y
IT	CCCCC	ABILITY	N
		ENABLE	Y
			N
			Y
	AAAAA	ENABLE	Y
			Y
			N
			Y
OT	CCCCC	QBS	Y
PL	AAAAA	BASIC	Y
PM	CCCCC	EXPERT SYSTEM	Y
		TIMELINE	Y
SS	BBBBB	LOTUS 123	Y
			Y
		SUPERCALC 3	Y
	CCCCC	LOTUS 123	Y
			Y
			Y
			Y
		PERFECT CALC	

SW TYPE	UNIT	PRODUCT NAME	SATISFACTION
		QUATRO	Y
			Y
		SUPERCALC III	Y
		VP PLANNER	Y
			Y
			Y
			Y
	AAAAA	LOTUS 123	Y
			Y
			Y
			Y
			Y
ST	CCCCC	BASS	Y
		MATHCAD	Y
		MICROSTAT	Y
			Y
		POWERPACK	Y
WP	BBBBB	WORDSTAR	Y
			Y
		WRITESOFT	Y
	CCCCC	MULTIMATE	Y
		PEACHTEXT	Y
		VOLKSWRITER-3	Y
		WORDPERFECT	Y
		WORDSTAR	Y
			N
			N
			N
		WRITE ONE	Y

SW TYPE	UNIT	PRODUCT NAME	SATISFACTION
	AAAAA	PEACHTEXT	Y
			Y

Appendix 9: Product Comparisons

SW TYPE	UNIT	PRODUCT NAME	PRODUCT COMP	REASON FOR CHOICE
CO	CCCCC	COORDINATOR		
		MS-KERMIT	NO CONTROLLED STUDY WAS DONE	NOT A CONTROLLED SEARCH; GRASPING AT STRAWS; EVALUATION
		PROCOMM	NO CONTROLLED STUDY WAS DONE	NOT A CONTROLLED SEARCH; GRASPING AT STRAWS;
		SMART TERM 240	PROCOMM	
		Z STEM	NO CONTROLLED STUDY WAS DONE	NOT A CONTROLLED SEARCH; GRASPING AT STRAWS;
		ZSTEM		
	AAAAA	Z STEM	PROCOMM	PROCOMM USED FOR ACCESS FROM HOME
DB	BBBBB	CONDOR	NONE.	
		D BASE III+	NONE.	
		DBASE II;DBASEIII		
		DBASE III	PEACHTEXT	WORKSHOP RECOMM; SEMINARS;LIT REVIEWS
			NONE	STANDARD ZENITH CONTRACT
			ENABLE	ENABLE WOULD

SW TYPE	UNIT	PRODUCT NAME	PRODUCT COMP	REASON FOR CHOICE
				NOT MEET REQUIREMENTS DBASE IS MORE POWERFUL
		DBASE III+	NONE;PUBLIC DOMAIN SOFTWARE HINDERED BY LEGAL IMPLICATIONS	ON STANDARD CONTRACT
		MICROX	NONE.	USER FRIENDLY; SATISFIED REQUIREMENT; EASY TRAINING
		PARTS MASTER	NONE.	
			NONE.	USER FRIENDLY; SATISFIED REQUIREMENT; EASY TRAINING
	CCCCC	CONDOR		WORD PROCESSING IN DOS WAS KEY
		DBASE III	NONE	PERSONAL KNOWLEDGE OF CAPABILITIES
		DBASE III+	NO COMPETITION EDUCATION CONSIDERATION WAS THE MAIN DRIVER	COMPATIBLE WITH REST OF AF/ACADEMIC WORLD

SW TYPE	UNIT	PRODUCT NAME	PRODUCT COMP	REASON FOR CHOICE
	AAAAA	DBASE III	NONE	
GR	BBBBB	CHART	NONE;PUBLIC DOMAIN SOFTWARE HINDERED BY LEGAL IMPLICATIONS	ON STANDARD CONTRACT
			NONE.	HAD NO OTHER CHOICES
	CCCCC	HARVARD GRAPHICS	CHART	USER INTERFACE; EASE OF USE;EXCELLENT OUTPUT
			NONE	BASED ON PERSONAL PRODUCT EVALUATION
			CHART	MORE FRIENDLY; MORE OPTIONS;EASE OF USE
			CHART PRESEN-TATIONS	USER INTERFACE; QUALITY OF OUTPUT
			ENABLE	EASY TO LEARN
			NO NONE	NOT A CONTROLLED SEARCH; GRASPING AT STRAWS; EVALUATION
			SLIDEMASTER	QUALITY
			CHART	UTILITY AND PRICE;DOES JOB BETTER AND EASIER
	AAAAA	CHART	NONE	

SW TYPE	UNIT	PRODUCT NAME	PRODUCT COMP	REASON FOR CHOICE
IT	CCCCC	ABILITY	ENABLE; FRAMEWORK OPEN ACCESS	ONLY ONE WHICH COULD SATISFY REQUIREMENT (HOT LINKS)
		ENABLE	WORD PERFECT; DBASE III LOTUS 123	COST; AVAILABILITY
			PERFECT FILER LOTUS 123	TRANSPORTABI-LITY
	AAAAA	ENABLE	WORDSTAR; MULTIMATE	USE ALL DUE SO LONG AS CAN CREATE/ RECEIVE ASCII FILES
			NONE; MANDATED BY HQ	
			NONE;NO OTHER INTEGRATED PACKAGES AVAILABLE	
OT	CCCCC	QBS	NONE	QUALITY;FREE
PL	AAAAA	BASIC	NONE	
PM	CCCCC	EXPERT SYSTEM		
		TIMELINE	HARVARD TPM;SUPER PROJECT EXPERT	STANDARD ZENITH CONTRACT MET NEED
SS	BBBBB	LOTUS 123	NONE.	HAD NO OTHER CHOICES
		SUPERCALC 3	NONE.	HAD NO OTHER CHOICES

SW TYPE	UNIT	PRODUCT NAME	PRODUCT COMP	REASON FOR CHOICE
	CCCCC	LOTUS 123	NO OTHER CHOICES	
			DBASE III DATA BASE MANAGEMENT SYSTEM	SS MET REQUIREMENTS DBMS WOULD HAVE BEEN OVERKILL
			MULTIPLAN BASED ON STUDENT SUPPORT AND COST	BETTER SUPPORT AND DOCUMENTATION I.E. LOTUS MAGAZINE ARTICLES
			NO	INTEROPERABILITY;TRANSPORTABILITY
		QUATRO	NO OTHER CHOICES	
		SUPERCALC III	NO OTHER CHOICES	
		VP PLANNER	NO OTHER CHOICES	
			NONE	PERSONAL KNOWLEDGE OF CAPABILITIES
	AAAAA	LOTUS 123	NONE;NO OTHER MET REQUIREMENTS	
			MS-EXCELL; BOENG CALC	LITERATURE/ TRAINING AVAILABILITY COMPATIBILITY KNOWLEDGE CONCENTRATED ON TIME LEARNING NEW PACKAGE
			SUPERCALC; VP PLANNER DECALC	LITERATURE AVAILABILITY COMPATIBILITY PORTABILITY EASE

SW TYPE	UNIT	PRODUCT NAME	PRODUCT COMP	REASON FOR CHOICE
ST	CCCCC	BASS	STATISTIX STAT-GRAPHICS; MICROSTAT; TASKS = STUDENT AIDS ISP;ICS	FULLY SATISFIED REQUIREMENT AND REASONABLY PRICED
		MATHCAD	STATISTIX STAT-ISP;ICS MICROSTAT; TASKS = STUDENT AIDS	FULLY SATISFIED REQUIREMENT AND REASONABLY PRICED
		MICROSTAT	NO STAT-GRAPHICS AS;SPSS/PC	MET REQ AND ALREADY ON ZENITH CONTRACT;LESS EXPENSIVE
		POWERPACK	STATISTICS STAT-GRAPHICS; MICROSTAT; ISP;ICS TASKS = STUDENT AIDS	FULLY SATISFIED REQUIREMENT AND REASONABLY PRICED
WP	BBBBB	WORDSTAR	NONE	STANDARD ZENITH CONTRACT
		WRITESOFT	NONE;PUBLIC DOMAIN SOFTWARE HINDERED BY LEGAL IMPLICATIONS	ON STANDARD CONTRACT
	CCCCC	MULTIMATE	NO OTHER CHOICES	

SW TYPE	UNIT	PRODUCT NAME	PRODUCT COMP	REASON FOR CHOICE

	PEACHTEXT	NO OTHER CHOICES	
	VOLKSWRITER-3	NO OTHER CHOICES	
	WORDPERFECT	WORDSTAR	COMPATIBILITY
	WORDSTAR	NO OTHER CHOICES	
		NO CONTROLLED STUDY WAS DONE	NOT A CONTROLLED SEARCH; GRASPING AT STRAWS; EVALUATION
		MAINFRAME	TRANSPORTA-BILITY
		SYSTEM WORD PERFECT;MS WORD;PC WRITE; VOLKS WRITER MULTIMATE	FORMAT;TRANS-PORTABILITY; STUDENTS WERE FAMILIAR WITH IT
	WRITE ONE	NO OTHER CHOICES	
AAAAA	PEACHTEXT		
		NONE; STANDARD CONTRACT	

Appendix 10: Recurring Tasks Simplified By Software

SW TYPE	DAILY TASKS	QUARTERLY TASKS	ANNUAL TASKS
CO	COMMUNICATION ORGANIZING SCHEDULING COMMUNICATION		
	COMMUNICATION INTEROPERABILITY		
DB	ORGANIZING/ SCHEDULING DIAGNOSIS/ PROBLEM FINDING MONITORING/ CONTROL MONITORING/ CONTROL	MONITORING/ CONTROL AUTHORING/ PRESENTATION	MONITORING/ CONTROL
	MONITORING/ CONTROL; ORGANIZING/ SCHEDULING	DIAGNOSIS/ PROBLEM FINDING	AUTHORING/ PRESENTATION
	ORGANIZING/ SCHEDULING; MONITORING CONTROL	MONITORING/ CONTROL	
	ORGANIZING/ SCHEDULING; MONITORING/ CONTROL	MONITORING/ CONTROL	
	ORGANIZING/ SCHEDULING; DIAGNOSIS/ PROBLEM FINDING ALL	MONITORING/ CONTROL	MONITORING/ CONTROL
		DIAGNOSIS PROBLEM FINDING	DIAGNOSIS/ PROBLEM FINDING
	ORGANIZING/ SCHEDULING; MONITORING/ CONTROL	MONITORING/ CONTROL; AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION
GR	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION	AUTHORING/ PRESENTATION

SW TYPE	DAILY TASKS	QUARTERLY TASKS	ANNUAL TASKS
			AUTHORING/ PRESENTATION
	AUTHORING PRESENTATION	AUTHORING PRESENTATION AUTHORING PRESENTATION	
	AUTHORING PRESENTATION	AUTHORING PRESENTATION AUTHORING PRESENTATION	MONITORING/ CONTROL
	AUTHORING PRESENTATION AUTHORING PRESENTATION AUTHORING PRESENTATION AUTHORING PRESENTATION AUTHORING PRESENTATION	AUTHORING PRESENTATION	
		MONITORING/ CONTROL	
	AUTHORING PRESENTATION		
IT		DIAGNOSIS/ PROBLEM FINDING	DIAGNOSIS/ PROBLEM FINDING
	AUTHORING PRESENTATION; MONITORING/ CONTROL; ORGANIZING/ SCHEDULING		
	AUTHORING PRESENTATION	AUTHORING PRESENTATION	
	AUTHORING PRESENTATION	MONITORING/ CONTROL	MONITORING/ CONTROL
		MONITORING/ CONTROL	AUTHORING PRESENTATION; MONITORING/ CONTROL DIAGNOSIS/ PROBLEM FINDING
	AUTHORING PRESENTATION	AUTHORING PRESENTATION;	

SW TYPE	DAILY TASKS	QUARTERLY TASKS	ANNUAL TASKS
		MONITORING/ CONTROL	
OT			
PL		TRANSPORTABILITY INTEROPERABILITY	
PM	MONITORING/ CONTROL;SYSTEM DEVELOPMENT		SYSTEM DEVELOPMENT
SS	DIAGNOSIS/ PROBLEM FINDING	DIAGNOSIS/ PROBLEM FINDING	
	DIAGNOSIS/ PROBLEM FINDING; PLANNING DECISION MAKING	AUTHORING PRESENTATION	
	DIAGNOSIS/ PROBLEM FINDING; SYSTEM DEVELOPMENT		
	MONITORING/ CONTROL AUTHORING PRESENTATION; MONITORING/ CONTROL	MONITORING CONTROL AUTHORING PRESENTATION	MONITORING CONTROL
	DIAGNOSIS/ PROBLEM SOLVING		
	ORGANIZING/ SCHEDULING	MONITORING CONTROL	
	INTER-OPERABILITY	MONITORING; CONTROL	PLANNING/DECISION
	PLANNING/ DECISION MAKING		MAKING;AUTHORING PRESENTATION
	MONITORING/ CONTROL AUTHORING PRESENTATION	MONITORING CONTROL DIAGNOSIS/ PROBLEM FINDING;	AUTHORING PRESENTATION

SW TYPE	DAILY TASKS	QUARTERLY TASKS	ANNUAL TASKS
		PLANNING/ DECISION MAKING	
ST	DIAGNOSIS/ PROBLEM FINDING		
		AUTHORING PRESENTATION; DIAGNOSING/ PROBLEM FINDING	
WP	AUTHORING PRESENTATION	MONITORING CONTROL	
	AUTHORING PRESENTATION; COMMUNICATION		AWARDS AND DECORATIONS; AUTHORING PRESENTATION
	AUTHORING PRESENTATION		
	AUTHORING PRESENTATION		
	AUTHORING PRESENTATION		
		AUTHORING PRESENTATION	ALL
	AUTHORING PRESENTATION	MONITORING CONTROL	AUTHORING PRESENTATION

Appendix 11: Perceived Hourly Usage of Software per Week

SW TYPE	PRODUCT NAME	CRIT PROD#	UNIT	OFFICE	HRS USED WK
CO	COORDINATOR	2	CCCCC	LLL	2.0
	SMART TERM 240	1	CCCCC	LLL	1.0
	Z STEM	3	AAAAA	III	100.0
DB	CONDOR	1	BBBBB	FFFF	25.0
	D BASE III+	2	BBBBB	FFFF	10.0
	DBASE II;DBASEIII	1	BBBBB	HHHME	35.0
	DBASE III	1	BBBBB	HHHME	35.0 30.0
		2	BBBBB	HHHMS	10.0
		3	AAAAA	IIIII	1.0
	DBASE III+	2	BBBBB	FFFFPA	20.0
	MICROX	1	BBBBB	HHHCDI	80.0
	PARTS MASTER	1	BBBBB	HHHCX	8.0
		2	BBBBB	HHHCDI	80.0
GR	CHART	1	BBBBB	FFFFPA	30.0
			AAAAA	GGGGG	15.0
		2	BBBBB	FFFF	2.0
			AAAAA	EE	30.0
		3	BBBBB	HHHCR2	0.5
	HARVARD GRAPHICS	1	CCCCC	DDD	80.0
					100.0 5.0
		2	CCCCC	FFZ	20.0

SW TYPE	PRODUCT NAME	CRIT PROD#	UNIT	OFFICE	HRS USED WK
				DDD	2.0
		3	CCCCC	LL	150.0
				FFFA	4.0
				FFZ	2.0
				FFF	2.0
IT	ABILITY	1	CCCCC	FFFA	10.0
	ENABLE	1	AAAAA	III	150.0
				EE	1000.0
					40.0
		2	CCCCC	FFF	40.0
				DDD	20.0
			AAAAA	IIIII	1.0
		3	CCCCC	DDD	1.0
OT	QBS	2	CCCCC	DDD	5.0
PL	BASIC	3	AAAAA	GGGGG	1.0
PM	TIMELINE	3	CCCCC	DDD	5.0
SS	LOTUS 123	1	BBBBB	HHHCR2	1.5
				FFFF	12.0
			CCCCC	FFZ	15.0
			AAAAA	IIIII	13.0
		2	CCCCC	FFZ	10.0
			AAAAA	GGGGG	5.0
				III	50.0
				EE	300.0

SW TYPE	PRODUCT NAME	CRIT PROD#	UNIT	OFFICE	HRS USED WK
		3	CCCCC	FF	1.0
			AAAAA	EE	20.0
	QUATRO	3	CCCCC	FF	1.0
	SUPERCALC III	3	CCCCC	FF	1.0
	VP PLANNER	1	CCCCC	FFG	10.0
		3	CCCCC	FF	1.0
ST	BASS	3	CCCCC	LLL	5.0
	MICROSTAT	1	CCCCC	FFZ	10.0
		3	CCCCC	FFZ	5.0
	POWERPACK	3	CCCCC	LLL	5.0
WP	MULTIMATE	1	CCCCC	FF	15.0
	PEACHTEXT	1	CCCCC	FF	15.0
			AAAAA	EE	45.0
		3	AAAAA	EE	75.0
	VOLKSWRITER-3	1	CCCCC	FF	15.0
	WORDPERFECT	1	CCCCC	DDD	30.0
	WORDSTAR	1	BBBBB	HHHMS	20.0
			CCCCC	FF	15.0
				FFF	15.0
		2	BBBBB	HHHCR2	0.5
			CCCCC	LL	750.0
				FFFA	4.0

SW TYPE	PRODUCT NAME	CRIT PROD#	UNIT	OFFICE	HRS USED WK
	WRITE ONE	1	CCCCC	FF	15.0
	WRITESOFT	3	BBBBB	FFFFPA	20.0

Appendix 12: User Comments

UNIT	OFFICE	COMMENTS
BBBBB	HHHC	IT'S MUCH EASIER FROM A MANAGER'S STANDPOINT, TO ORDER ALL THE SOFTWARE WE THINK WE MAY USE IN THE FUTURE. GENERALLY, ALL SOFTWARE REQUIREMENTS WERE BASED ON AN ASSESSMENT OF FUTURE NEEDS, WHAT WAS ON THE STANDARD ZENITH CONTRACT, AND THE PRICE OF THE SOFTWARE. NO REAL FORMAL REQUIREMENTS ANALYSIS WAS CONDUCTED.
	HHHCDI	PLAN TO UPDATE MICROX TO ELIMINATE MULTIPLE DISKS (PLAN TO CONSOLIDATE INTO ONE DISKETTE)
	HHHCR2	MAY USE BOING CALC
	HHHCX	SOFTWARE STORE - OBTAIN SOFTWARE FOR BASE; CUSTOMERS SUBMIT REQUIREMENT; STORE PROCESS REQUIREMENTS; CONTRACTING BUYS (MR XXXXXX); S.W. STORE CAN BUY UP TO $5000 DIRECTLY; FROM STORES OFF BASE THROUGH A BUYER - PURCHASE AGREEMENT (4 COMPANIES); OPEN SINCE 1986 - STARTED WITH 40 ITEMS; UP TO OVER 200 LINE ITEMS.
	HHHME	SOFTWARE HAS SATISFIED NEED TO TRACK EQUIPMENT, INVENTORY, SERVICE, AND SCHEDULE/SERVICE TECHNICIANS; TRACKS TRANSACTIONS AND MAKES USE OF MANPOWER;TRACKS EXPENDITURES BY ORGANIZATIONS COMPUTER TRAINING IS DIFFICULT TO OBTAIN. THIS PREVENTS MORE PEOPLE FROM GAINING MAXIMUM USE OF THE SYSTEMS.
	HHHMS	COMPUTER TRAINING IS DIFFICULT TO OBTAIN. THIS PREVENTS MORE PEOPLE FROM GAIN MAXIMUM UTILIZATION FROM THE SYSTEM AND THE SOFTWARE.

UNIT	OFFICE	COMMENTS
	FFFF	WILL BE USING LOTUS 123 MORE NOW THAT WE HAVE A NEW SINGLE SHEET FEED PRINTER - ESTIMATE 14 HOURS PER WEEK
	FFFF	PEOPLE ARE ENTHUSIASTIC ABOUT SOFTWARE; NEW PEOPLE ARE INTIMIDATED AT FIRST
CCCCC	LL	WP: INTEROPERABILITY IS A PROBLEM; HARVARD GRAPHICS IS VERY SUCCESSFUL. INTEROPERABILITY MAJ IS STILL A PROBLEM; EMULATORS USED CONTINUOUSLY NEED MORE GUIDANCE WITHOUT STIFFLING INNOVATION; NEED TO EVOLVE STANDARDS; DO NOT IMPOSE STANDARD;
		29 FEB 88 XXXXXXXXXXXX; TRIED TO GET STAFF SC SUPPORT BUT WAS REFUSED FOR REQUIRMENTS ANALYSIS; EMULATORS DOES MAINFRAME CONNECTIVITY, DOES NOT ESTABLISH BACKWARD COMPATIBILITY (BURROUGHS) AND INTEROPERABILITY, 3 DIFFERENT EMULATORS, NO STANDARD;
	LLL	AQISITION PROCESS - FM 3215 JUSTIFY, SOLE SOURE LETTER AFSC FM 36, PURCHASE; WISH A SYSTEM BE DEVISED TO OBTAIN SW DECISION AT LOWEST LEVEL POSSIBLE - USERS MAKE THE BEST REQUOIREMENTS ANALYSIS - CURRENT REQUIREMENTS COME FROM TOP
	FF	MOST SW SELECTED DUE TO COURSE REQUIREMENTS;EMPHASIS IS ON TEACHING STUDENTS AND RESEARCH; COST EFFECTIVENESS IS FACTOR;JUST PURCHASED 10 COPPIES OF DBASE III+ (EASY TO LEARN); TRY TO GET SYSTEMS COMPATIBLE; MOST WP AND SS DONE ON BURROUGHS DUE TO HARDWARE CONSTRAINTS; ONLY 12 Z248S AVAILABLE TO FACULTY;FFF - LTCOL XXXXXXX ;DDD LTCOL XXXXXXX

UNIT	OFFICE	COMMENTS
	FFG	AWKWARD; CURRENTLY A GRAD STUDENT IS DEVELOPING A PROGRAM USING DBASE III TO ACCOMPLISH THE MANAGEMENT TASKS PERFORMED BY VP PLANNER CCCCC/SC KEEPS TRACK, INSTALLS, MAINTAINS ALL EQUIPMENT; BUT THEY DO NOT PERFORM APPLICATIONS PROGRAMMING FOR USERS; THIS FORCES USERS TO LOOK FOR THEIR OWN SW AND APPLICATIONS; WOULD LIKE SC TO HELP DEFINE REQMNTS AND SELECT/DEVELOPE APPROPRIATE SW; VP PLANNER ACQUIRED TO ACCOMPLISH MGT OF PC-BASED GRAD STUDENT DATABASE; THIS STREAMLINED ACCESS TIMES AND REPORTS GENERATION TIMES; HOWEVER, DATA ENTRY STILL CUMBERSOME AND SLOW
	FFF	CURRENT POLICY IS TO TRY TO PROVIDE SET OF TOOLS STUDENTS CAN TAKE AND LEAVE WITH READILY AND AT REASONABLE COST; PC SW CAN HELP MEET THIS GOAL; NO EFFICIENT USE OF WP DUE TO LACK OF HW SUPPORT;LAST YEAR TURBOPASCAL WAS ONE OF TOP 3 PKGS - SW ENVIRONMENT CHANGES RAPIDLY; SW SUPPORT FOR TEXTBOOKS IS CRITICAL FACTOR; GET INVENTORY SUMMARY FROM LTCOL XXXXXXX OR LTCOL XXXXXXXXXXX
	FFFA	STUDENTS, STAFF WOULD RESULT IN BETTER REQUMNTS ANALYSIS/USE DOWN THE ROAD, AF WIDE; BUY OFF GOVT CONTRACT SOLEY BECAUSE OF COST, NOT BECAUSE OF REQUMNTS (ITS EASIER TO BUY EVERYTHING UP FRONT AND JUSTIFY LATER); PEOPLE BUYING PERSONAL SW TO MEET MISSION REQUMNTS; GOVT SW IS INADEQUATE AND STAYS ON SHELF; CCCCC/SC IS A HINDERANCE; SW ON GOVT CONTRACT NOT UPGRADEABLE; CCCCC MGT SHOULD FOCUS ON FOLLOWING, NOT LEADING SW TESTING/EVAL; SHOULD SERVE AS ACADEMIC EVAL FACILITY FOR NEW SW

UNIT	OFFICE	COMMENTS
		MOST SW IS PRIVATELY OWNED SW; PEOPLE NOT FREE TO DETERMINE THEIR SW NEEDS; THEY ARE FORCED TO TAKE WHAT IS GIVEN; ACQ PROCESS IS LONG AND COSTLY; TOO MUCH FOCUS ON STANDARDIZATION; THIS DOES NOT ENHANCE OUR MISSION REQUMNTS, E.G. ENABLE WAS NOT GOOD SUBSTITUTE FOR DBASE III; WORDSTAR4 (PERSONAL CY) MUCH BETTER THAN WORDSTAR, BUT I CAN'T GET FORMALLY SINCE NOT ON GOVT CONTRACT
	FFZ	NEED TO STREAMLINE BUYING OF SW; UNITS NEED MORE AUTONOMY WHEN DECIDING WHAT SW SHOULD BE PURCHASED; STANDARD CONTRACT TOO RESTRICTIVE; ORGN SHOULD BE ABLE TO BUY THE RIGHT TOOL FOR JOB, NOT TRY TO FIT STANDARD CONTRACT SW TO JOB IT WAS NOT DESIGNED TO DO; MAYBE WE COULD SELECT SW BASED ON ITS TRANSPORTABILITY MANY SW WERE DRIVEN BY PRIOR MAINFRAME APPLICATIONS; PC APPLICATIONS MUCH EASIER TO USE IN CLASSROOM ATMOSPHERE
	FFF	NOT ABLE TO IDENTIFY APPROPRIATE SW; INITIALLY, AUTOMATION WAS DONE WITH PRIVATE HW AND SW; WHEN ZENITH WAS ACQUIRED, ZENITH SW WAS GATHERED MORE (SCTC AT MISSION LEVEL); BY PUTTING OUT FREE ACCESS COMPUTERS AND SW, MGT AND CONTROL IS A PROBLEM; WORDSTAR - LIMITED BY CAPABILITY OF TRANSPORTABILITY/INTEROPERABILITY; ENABLE - TEXT PRODUCTION LIMITATIONS/LESS EFFICIENT WORDPROCCESSOR; NEED TO REKEY INFO; NO IMPORT CAPABILITY NO INTEROPERABILITY; HARVARD GRAPHICS NOT ENOUGH PREDEFINED SYMBOLS; NO GRAPHICS LIBRARY/SLOW PRINTING PROCESS; NEEDS WERE IDENTIFIED IN ADVANCE, BUT WE WERE NOT ABLE TO BUY

UNIT	OFFICE	COMMENTS
		1)IS NEED FOR INTEGRATION OF SW/HW SYSTEMS TO REDUCE DUPLICATION OF EFFORT; STORED INFO USED BY DIFFERENT DEPTS SHOULD NOT HAVE TO BE RECREATED, BUT ANY SUCH SYSTEM MUST INDIVIDUAL TAILORING TO MEET REQUIREMENTS; 2) NEED A CCCCC AGENCY WITH SW LIBRARY; HANDS ON EVAL BY USERS (WITHIN CCCCC); CENTRAL REPOSITORY/SITE LISCENCE AGREEMENTS THIS MAY SPEED ACQUISITION, USE AVAILABILITY, AND KNOWLEDGE OF PRODUCTS; WOULD SAVE MUCH TIME AND MONEY
	DDD	HARVARD GRAPHICS IS USED 75% OF EACH WORK DAY. ALL SOFTWARE REQUIREMENTS ARE LIMITTED BY THE AVAILABILITY OF MACHINES; WE ONLY HAVE 2 Z-248'S AVAILABLE. MOST WORK IS DONE ON THE BURROUGHS SYSTEM, WHICH DOES NOT ALLOW INTEROPERABILITY WITH THE Z-248'S. ENABLE AND ZSTEM ARE ONLY USED 1% OF THE TIME DUE TO THIS LIMITATION. USE SOFTWARE UNIQUE TO PARTICULAR JOB; SC AND FORMAL REQMTS TOO RESTRICTIVE; PRIVATE PROPERTY USED; MANY TASKS ACCOMPLISHED AT HOME, THUS PERSONAL SW AQUIRED INDIVIDUALLY IS USED - QBS,SLAM,STAT PKGS,WORD PROCESSORS;CONFLICT BETWEEN (GFE) FORMAL VS (PERSONNEL) PRIVATE SW THE DRIVING FORCE BEHIND OUR REQUIREMENTS IS THE NEED TO HAVE SOFTWARE THAT IS COMPATIBLE WITH WHAT PROFESSORS ARE USING AT HOME (THEY ARE ALLOWED TO WORK THERE WHEN NOT TEACHING). IN GENERAL, WE ARE GOING TO AN M-S DOS BASED SYSTEM. IN THE ACADEMIC ENVIRONMENT, WORK IS DONE AT HOME AND AT THE OFFICE; COMPATIBILITY BETWEEN HOME AND OFFICE SYSTEMS BECOMES MORE OF A NECESSITY; AS AN ACADEMIC INSTRUCTOR, ACADEMIC PAPERS ARE SUBMITTED IN WORD

UNIT	OFFICE	COMMENTS
		PERFECT FORMATTED DISKETTES. THE SYSTEMS NEED TO BE MORE STANDARDIZED/COMPATIBILITY WITH THE REST OF THE ACADEMIC COMMUNITY. WE ARE STRUGGLING WITH COMPUTER NEOPHYTES; NOVICE USERS STILL DO NOT KNOW WHAT SW IS AVAILABLE FOR STREAMLINING JOBS; USERS MUST GET SMARTER IN PC KNOWLEDGE SO THEY CAN BETTER DEFINE THEIR SW REQUIREMENTS DBASE III + REQUIREMENTS ANALYSIS;INTENDED AS AN INSTRUCTION AIDE
AAAAA	GGGGG	VAST MAJORITY OF SW CAME WITH SYSTEM VIA STANDARD ZENITH CONTRACT; GOVT SW IS SECOND HAND COMPARED TO COMMERCIALLY AVAILABLE SW
	III	LOT OF PUSH ON STANDARDIZATION; SHOULD BE LESS ON STANDARDIZATION AND MORE ON APPLICATIONS, USER NEEDS, EXCHANGEABILITY/INTERCHANGEABILITY OF DATA
	IIIII	TRAINING AVAILABILITY IS KEY FACTOR IN SELECTING SW; TYPE OF PEOPLE IS ALSO FACTOR; YOUNGER PEOPLE MORE APT TO CHANGE; ONCE USERS LEARN ONE SYSTEM, DO NOT WANT TO CHANGE; COMPATABILITY OF SYSTEMS AND SW WITH OTHER ORGS IS ANOTHER KEY FACTOR; WHEN WE GET MORE PC'S AND WORK STATIONS, WE PLAN TO LOOK AT MORE SW TO FACILITATE COMMUNICATIONS AND EMAIL
	II	THE KEY IS "USERS DO NOT HAVE ENOUGH INPUT INTO DETERMINING THEIR REQUIREMENTS OR SELECTING SOFTWARE".; THE PRODUCTS ARE EXCELLENT AND RELIABLE.; "MAYBE A TRIAL/SAMPLE USE WOULD HELP." THE KEY IS "USERS DO NOT HAVE ENOUGH INPUT INTO DETERMINING THEIR REQUIREMENTS OR SELECTING SOFTWARE".;THE PRODUCTS ARE EXCELLENT AND RELIABLE.;"MAYBE A

UNIT	OFFICE	COMMENTS
		TRIAL/SAMPLE USE WOULD HELP.";CONSULTED USERS AND ORGANIZATIONS TO SEE WHAT SOFTWARE PRODUCTS APPROPRIATE FOR MISSION REQUIREMENTS. IN ACQUIRING SOFTWARE, USER'S NEEDS ARE THE DRIVING FORCE. SOFTWARE NOT DEFINED BY USES IS SELDOM USED. ISSCO GRAPHICS IS AN EXAMPLE OF A POORLY DEFINED REQUIREMENT.

Appendix 13: The Use of Q&A DBMS for Data Analysis

General

Q&A is a flat file data base management system, much like the popular Dbase III software package. In addition to allowing the user to design a data base, input and manipulate data, and generate reports, the software package also contains utilities for exchanging information with several popular data base management systems, spreadsheets, and ASCII text formats. Q&A's strength lies in it's ability to handle both recurring reports necessary for generation as well as ad hoc queries (through the use of its natural language interface known as the Intelligent Assistant). Because of these features, along with the system's ease of use, interoperability, and data transportability, Q&A appeared as a likely choice for organizing data generated for this study. This section explains the approach used in designing the data bases used for literature and data analysis, the data input procedures, and the analysis methods.

Data Base Design

Two data bases were designed for ease of analysis. The first data base, LITREV.DTF, consisted of technical literature used in Chapter II. The second data base, DBFILE.DTF contained fields representative of the survey questions listed in Appendix 1. Figures 15 and 16 display data input screens developed for the respective data bases.

The approaches used to design each data base were similar, and involved two main steps including 1) determining the desired outputs, and 2) determining the inputs necessary to obtain the desired outputs.

The first step was to determine what output was necessary for analysis. In the case of the LITREV.DTF data base, the desired output was a listing, by category, of key points in documents reviewed. Thus, when analyzing all the available literature on design considerations, the ability to extract similar comments from reports and compile them in one list was considered a necessary requirement. The rest of the data base was designed around this key ingredient.

For the DBFILE.DTF data base, the desired output was a series of reports necessary to answer the research questions stated in Chapter I. The determining factor in these reports was the need for information sorted by a series of different fields, including software type, critical software products, organizations, and office symbols.

Once the desired outputs were determined, the second step, determination of inputs necessary to obtain the outputs was undertaken. In the case of the literature review data base, the bibliographical data was necessary for documentation as well as traceability of the comments. In addition, a "key words" field was added to allow the ability to sort comments based on the desired topics.

The survey data base employed the survey questions as input fields. To facilitate analysis, the input phrases were standardized prior to data entry. Help facilities were designed into the data base to allow the data entry operator to determine which phrases to use (i.e., CO for communications software, Y for yes, etc.). This standardization of data entry allowed easier sorting during reports generation for analysis.

Data Input Procedures

For the LITREV.DTF data base, data input was relatively straightforward. The bibliographical information was entered in the appropriate fields, as were comments from the articles reviewed. Within each record, literature categories were noted in the "key words" field. For areas where more than one key word was appropriate (i.e., Design Considerations, User Involvement) the key words were separated by a semi-colon. This feature allowed the same data to be generated in reports which asked for either key word.

The DBFILE.DTF data base input involved more detailed input procedures. Originally, data was intended for input directly the way it appeared on the survey questionnaire. However creation of one record for each individual surveyed proved unfeasible because of the number of software products mentioned by each respondents, and the length of some comments. To facilitate an accurate account of each field,

records were created based on each software product mentioned by the individuals. Thus, if a person identified thirty software products, thirty records were created with that individual's name, organization and office symbol. The copy command allowed easy input of redundant information. In addition, if comments extended beyond the defined field length, another record (stripped of all previous data except name and organization), was created. As a result of the way input criteria were defined, 241 records were generated for 29 respondents in the DBFILE.DTF data base.

Data Analysis Methods

Analysis of both literature and survey data was streamlined once the data base reports were generated. For example, when looking for important points to mention in design considerations, a list of comments and observations was readily examined. In some cases, quotes or remarks were directly imported into a word processor file, eliminating the need for input duplication. Survey data was arranged in such a fashion as to allow easy observation of trends, based on the way data was sorted. For example, critical software products were much easier to categorize and count when arranged by software type in alphabetical order. Like the literature review information, the reports were quickly converted to word processing text. Appendices 2 through 12 were generated by Q&A and saved as MS-DOS files for integration into one file.

Summary

The Q&A software demonstrated it's effectiveness by allowing easy manipulation of information required for analysis. By designing reports based on research objectives, the literature review and the analysis of survey data were easily accomplished.

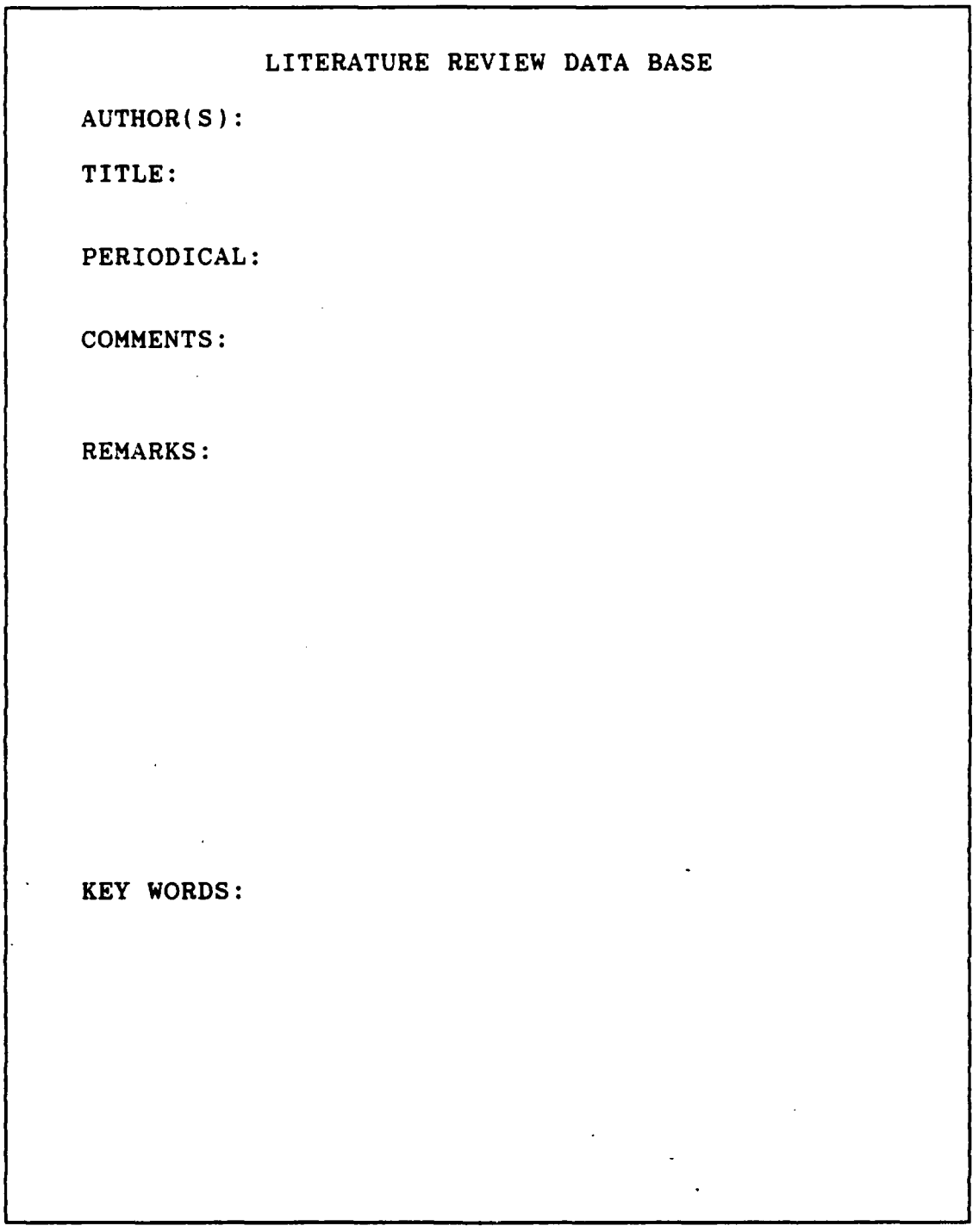

Figure 15. LITREV.DTF Data Base Design

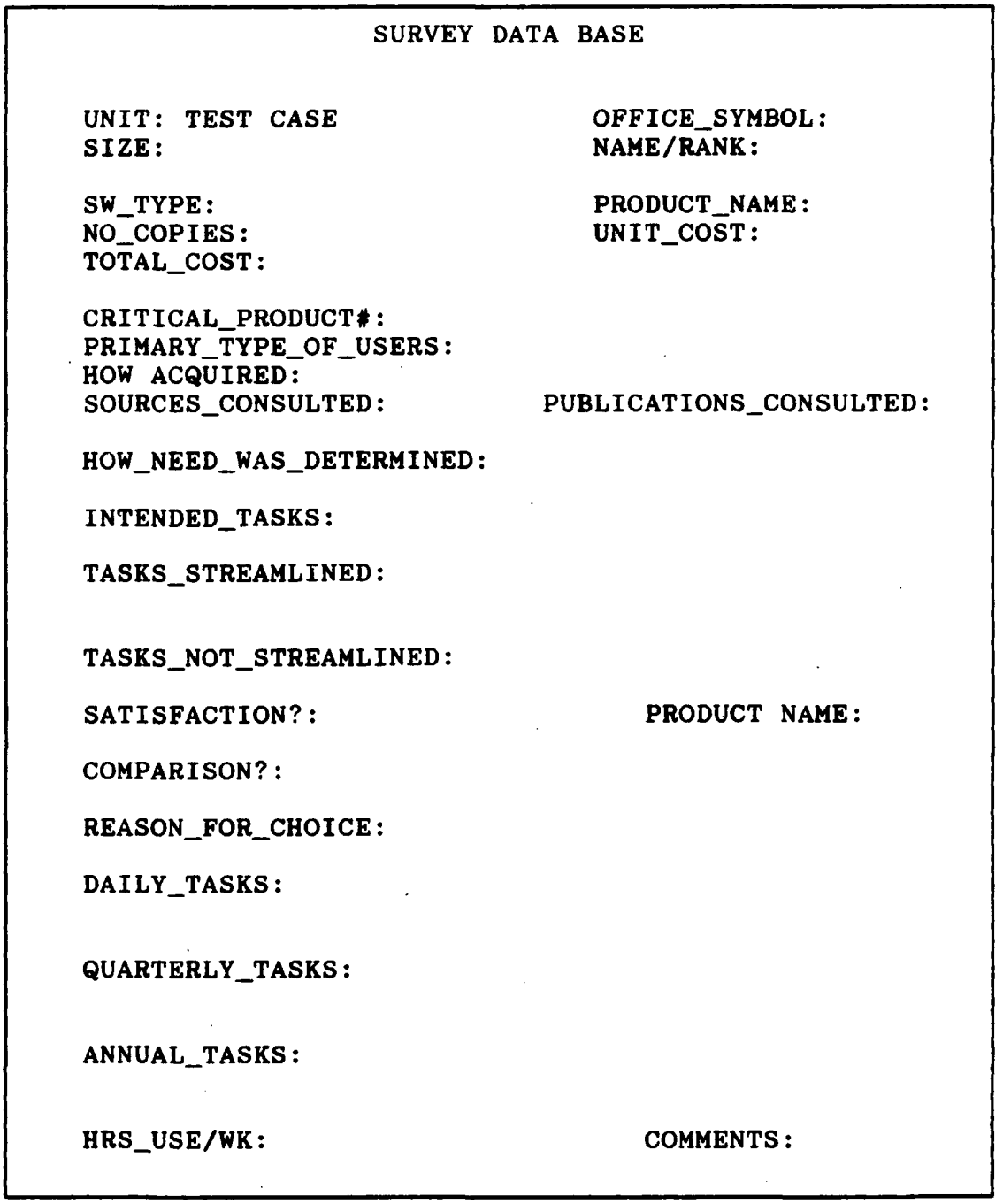

Figure 16. DBFILE.DTF Data Base Design

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The Purpose of this study was to determine how Air Force Organizations selected Personal Computer (PC) software, to determine the effectiveness of standard PC software acquisition practices, and to determine if better methods could be developed. The study had three basic objectives:

1. Determining whether or not a uniform set of PC software selection criteria existed at base level;

2. Determining how effective the existing methods of selecting PC software were;

3. Determining what additional factors organizations should evaluate before acquiring PC software.

Analysis of interviews with thirty managers and users from four Air Force organizations resolved that while a normative or regulatory approach existed for determining PC software requirements, the guidance was not clear in helping users select the appropriate software for automated office tasks. As a remedy for a lack of sufficient guidance, organizations chose to select software first and then find a need to fit the software. Data suggested, however, that at times this resulted in less than optimum use of the software.

A requirements analysis model was necessary to specifically provide users with a means of categorizing their information systems requirements into knowledge work tasks, and to select software designed to satisfy the identified knowledge work. The model, developed using tasks identified by the interview respondents and literature available on the subjects of management information system design, user involvement, and requirements analysis techniques, is presented and offered as a solution to the current problem.